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Ont (First and Second) Commission  
H Annual Reports

OF THE

# Hydro-Electric Power Commission

OF THE

PROVINCE OF ONTARIO

(1908/09)

ENDING OCTOBER 31st, 1909. 11122

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THE LEGISLATIVE ASSEMBLY OF ONTARIO

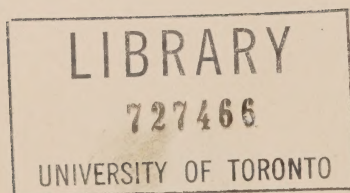
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TORONTO

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1910

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TO HIS HONOUR JOHN MORISON GIBSON, K.C., LL.D.,

*Lieutenant-Governor of Ontario.*

MAY IT PLEASE YOUR HONOUR.

The undersigned has the honour to present to your Honour the First and Second Annual Reports of the Hydro-Electric Power Commission of Ontario, ending the 31st of October, 1909.

Respectfully submitted,

ADAM BECK,

*Chairman.*

Toronto, July 15, 1910.





THE HONOURABLE ADAM BECK,

*Chairman Hydro-Electric Power Commission,  
Toronto, Ont.*

DEAR SIR:—

I have the honour to transmit herewith the First and Second Annual Reports of the Hydro-Electric Power Commission of Ontario, ending 31st of October, 1909, which contain engineering reports of P. W. Sothman, Chief Engineer, and copies of the Acts established and relating to the Commission up to that date, together with copies of Orders-in-Council, naming the members of the Commission.

I have the honour to be, Sir,

Your obedient servant,

W. W. POPE,

*Secretary.*

Toronto, July 15, 1910.





HYDRO-ELECTRIC POWER COMMISSION  
OF ONTARIO

---

HON. ADAM BECK, London, Chairman.

HON. JOHN S. HENDRIE, C.V.O., Hamilton, Commissioner.

W. K. MCNAUGHT, ESQ., M.P.P., Toronto, Commissioner.





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# FIRST ANNUAL REPORT

ENDING DECEMBER 31st, 1908.

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COPY OF AN ORDER-IN-COUNCIL APPROVED BY HIS HONOUR THE LIEUTENANT-GOVERNOR, THE 26TH DAY OF JANUARY, A.D. 1906

The Committee of Council have had under consideration the report of the Honourable the President of the Council, dated 25th January, 1906, wherein he states that on the 5th day of July, 1905, an Order-in-Council was passed under the provisions of "The Act respecting Inquiries Concerning Public Matters" (R.S.O., 1897, Cap. 19), appointing the Honourable Adam Beck, of the City of London, George Pattinson, of the Town of Preston, Esquire, and Philip William Ellis, Esquire, of the City of Toronto, Commissioners, to inquire into and report upon certain matters therein more particularly set out, and that the said Philip William Ellis has expressed his desire to resign from his position as a Commissioner under the aforesaid Commission.

The Committee advise that the resignation of the said Philip William Ellis be accepted, and that he be relieved from his duties under the said Commission, and that the said the Honourable Adam Beck, the said George Pattinson, and John Milne, of the City of Hamilton, Esquire, be appointed jointly and severally Commissioners to inquire into and report upon:—

1. The present and probable demand for hydraulic and electric power in the various districts capable of being supplied from the different water powers within the legislative jurisdiction of the Province of Ontario.

2. The location, capacity and capital cost of development of the various water powers within the legislative jurisdiction of the Province of Ontario at present undeveloped, but whose development is required to supply the present and probable needs of the surrounding districts, and to ascertain the capital cost of the attendant transmission plants necessary to the utilization of electric or hydraulic power to be derived from the aforesaid water powers within the respective surrounding districts.

3. To ascertain the rates of prices that would require to be charged the various classes of consumers of hydraulic or electrical power within the respective districts, in order to meet all expenditure of maintenance and operation.

4. To inquire into and ascertain the annual savings accruing to the consumers in the various districts aforesaid by the substitution of the rates or prices to be ascertained under the next preceding paragraph for the rates paid at present in the said Districts so far as the Commissioners may be able to ascertain or estimate them.

5. To inquire into and ascertain the cash capital cost of the hydraulic and electrical power undertakings of existing companies located within the Province of Ontario, the capacity and state of development thereof, and to ascertain further (a) the quantities of power supplied and contracted for and the rates charged and to be charged under such contract by these companies for hydraulic or electrical power; (b) the actual present value of the said undertakings (or such of them as may be required) after making such fair and reasonable allowance for existing conditions as in the judgment of the Commissioners seems necessary or expedient; (c) the estimated capital outlay (if any) necessary to complete these undertakings.

The Committee further advise that for the purpose of carrying out this inquiry the Commissioners be authorized to employ a Secretary, also to employ counsel, engineers, accountants, and such other technical expert and other assistance as may be necessary, and to fix the terms of remuneration to be paid for all such services and generally to do all acts necessary or expedient in the premises.



And the Committee further advise that the said Commissioners do adopt and report the proceedings and transactions had and taken before the Commissioners appointed under the aforesaid Order-in-Council of 5th July, 1905.

And the Committee further advise that the Commission confer upon the said Commissioners, the powers authorized by the above-mentioned act.

Certified,

J. LONSDALE CAPRÉOL,  
*Clerk Executive Council.*

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COPY OF AN ORDER-IN-COUNCIL APPROVED BY HIS HONOUR THE LIEUTENANT-GOVERNOR, THE 7TH DAY OF JUNE, A.D. 1906.

Upon the recommendation of the Honourable the President of the Council, the Committee of Council advise that under and for the purpose of the Act of last Session, entitled, "An Act to provide for the transmission of Electrical Power to Municipalities," the Honourable Adam Beck, the Honourable John Strathearn Hendrie, and Cecil B. Smith, Esquire, be appointed a Commission, to be a body corporate under the name of "The Hydro-Electric Power Commission of Ontario."

The Committee further advise that the said Honourable Adam Beck be the Chairman of the said Commission.

Certified,

J. LONSDALE CAPRÉOL,  
*Clerk Executive Council.*

---

COPY OF AN ORDER-IN-COUNCIL APPROVED BY HIS HONOUR THE LIEUTENANT-GOVERNOR, THE 28TH DAY OF FEBRUARY, A.D. 1907.

The Committee of Council advise that William K. McNaught, of the City of Toronto, Esquire, M.P.P., be appointed a Member of "The Hydro-Electric Power Commission of Ontario, in the room and stead of Cecil B. Smith, Esquire, resigned.

Certified,

J. LONSDALE CAPRÉOL,  
*Clerk Executive Council.*

# Acts Passed.

Your Commissioners were appointed in May, 1906, (6 Edward VII., Chap. 15). "An Act to provide for the Transmission of Electrical Power to Municipalities," which is hereunder recited:

No. 243]

BILL.

[1906

An Act to Provide for the Transmission of Electrical Power to Municipalities.

HIS MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:—

1. For the purposes hereinafter mentioned, the Lieutenant-Governor in Council may from time to time appoint a Commission to consist of three persons, two of whom may be members of the Executive Council of Ontario and one of whom shall be a member of such Executive Council, and such commission shall be a body corporate under the name of "The Hydro-Electric Power Commission of Ontario," hereinafter called "the Commission."

Appointment  
of Hydro-  
Electric Power  
Commission.

2. The Lieutenant-Governor in Council may designate one of the members of the Commission to be the Chairman thereof. Two of the members of the Commission shall form a quorum.

Chairman.  
Quorum.

3. Every person appointed to the Commission shall hold office during pleasure and the Lieutenant-Governor in Council may upon the death, resignation or removal from office of any member of the Commission appoint some other person to fill his place.

Tenure of  
office.

Vacancies.

4. The member or members of the Commission other than any member of the Executive Council shall be paid such salary or other remuneration as may be fixed by the Lieutenant-Governor in Council out of such moneys as may be voted by the Legislature for that purpose.

Salaries.

5. The Commission may, from time to time, appoint a Chief Engineer, an Accountant, and a Secretary, and such other engineers, accountants, officers, servants and workmen as may be deemed requisite. The salaries or other remuneration of the persons so appointed shall be payable out of such moneys as may be voted by the Legislature for that purpose.

Appointment  
of officers by  
Commission.

6. Any municipal corporation may apply to the Commission for the transmission to such corporation of electrical power or energy for the uses of the corporation and the inhabitants thereof, for lighting, heating and power purposes, and the Commission may thereupon furnish to such municipal corporation estimates of the cost of constructing,

Furnishing  
plans, speci-  
fications and  
estimates to  
municipal cor-  
porations, on  
application.

erecting, installing and maintaining all such buildings, works, plant, machinery, poles, wires, conduits and other structures as may be necessary for the purpose of supplying the amount of electrical power or energy required by such municipal corporation and may also furnish to such corporation plans and specifications of the works, plant, machinery and appliances necessary for the distribution of such power and energy by such municipal corporation, together with an estimate of the cost thereof. The Commission shall further furnish to such municipal corporation a statement of the terms and conditions upon which such electrical power or energy may be transmitted and supplied, together with a form of the contract to be entered into between such municipal corporation and the Commission.

Proviso.

Provided that neither the Commission nor the Province of Ontario shall incur any liability to any municipal corporation or company by reason of any error or omission in any such plans, specifications, or estimates.

Council may submit by-law to electors.

7. The council of such municipal corporation may submit to the electors of the municipality in the manner prescribed in *The Consolidated Municipal Act, 1903*, a by-law authorizing the municipal corporation to enter into such contract and in case such by-law receives the assent of the majority of the electors voting thereon, such contract may be entered into and executed by the Commission and the municipal corporation, subject to the approval of the Lieutenant-Governor in Council.

Transmitting and delivering power to municipality under contract.

8. After the execution of such contract and its approval by the Lieutenant-Governor in Council the Commission may proceed to transmit and deliver to the municipal corporation electrical power or energy to the extent mentioned in such contract, and the municipal corporation may receive, use, supply and distribute such electrical power or energy upon such terms and subject to such conditions as to rates and otherwise as the Commission may from time to time prescribe.

Supplying power to railways and distributing companies.

9.—(1) The Commission may, subject to the approval of the Lieutenant-Governor in Council, enter into contracts from time to time with railway companies or distributing companies for the supply of electrical power or energy for the purposes of such companies.

Profits to be applied in reducing cost of maintenance to municipalities.

(2) Any net profit made by the Commission, in supplying power to a railway company or distributing company under any such contract after making due provisions for the cost of acquiring or constructing and of maintaining the works through which the power or energy is supplied to such company, shall be applied in payment of the cost of maintaining the works, if any, acquired or constructed and operated by the Commission for the purpose of transmitting electrical power or energy to municipal corporations.

Agreements for use of right of way of railway companies.

(3) The Commission may, from time to time, with the approval of the Lieutenant-Governor in Council, enter into a contract with any railway company for the use of the right of way of such railway company for the erection of towers, poles, conduits, works and other constructions necessary for transmitting electrical power or energy by the Commission.



**10.** Every municipal corporation entering into a contract with the Commission as hereinbefore provided shall, for the purpose of using, distributing and supplying electrical power or energy so contracted for, have the powers, perform the duties and be subject to the like obligations as a municipal corporation constructing or acquiring works for supplying electrical power or energy under the provisions of *The Municipal Light and Heat Act* or *The Consolidated Municipal Act, 1903*. Provided that the clauses lettered (a) to (a9), both inclusive, following paragraph 4 of section 566 of *The Consolidated Municipal Act, 1903*, shall not apply to any municipal corporation receiving from the Commission and using and distributing electrical power or energy under the provisions of this Act, and it shall not be necessary for the council of any municipal corporation, before passing any by-law or issuing debentures thereunder for the purposes of this Act, to fix any price to be offered to any electric light company or gas company supplying or which has heretofore supplied electric light or gas in such municipality or to take any further or other proceedings having for their object the fixing a price to be paid by the municipal corporation for the works and plant of any such corporation or any part thereof, or the purchase or expropriation of such plant or any part thereof by such corporation, unless the Commission, upon application to it by any such electric light company or by the municipal corporation, shall otherwise order or direct.

Powers of municipalities.

**11.** The Commission may, from time to time, report to the Lieutenant-Governor in Council, designating such lands, water privileges, water powers or the lands, works, machinery and plant, or any portion thereof of any company or person owning, or holding under lease or otherwise, or developing, operating or using any water privilege or water power, or transmitting electrical or other power or energy in the Province of Ontario which should, in the opinion of the Commission, be purchased, acquired, leased, taken or expropriated, developed, operated or used by the Commission for the purposes of this Act, or may designate what quantity of the product of any such corporation or individual developing electrical power or energy in the Province of Ontario, or purchasing such power or energy the Commission requires for the purposes of this Act.

Report of Commission as to acquiring works, etc.

**12.** The Lieutenant-Governor in Council may, from time to time, upon the recommendation of the Commission, authorize the Commission:

Authority may be given to Commission.

- (a) To acquire by purchase, lease or otherwise, or without the consent of the owners thereof or persons interested therein to enter upon, take and use the lands, works, plant and property of any company or person owning, using and developing or operating lands, water, water privileges, or works, plant and machinery for the development of any water privilege or water power for the purpose of generating electrical power or energy or for the transmission thereof in the Province of Ontario, and to develop and supply electrical power or energy;

To acquire lands and works.

Plant and  
property of  
transmission  
companies.

- (b) To acquire by purchase, lease or otherwise, or without the consent of the owners thereof or persons interested therein to enter upon, take, use, and to construct, maintain and operate works, machinery, plant and appliances, lines of wires, poles, tunnels, conduits and other works for the transmission and delivery of electrical power or energy, and to conduct, store, transmit and deliver electrical power or energy, and with such lines of wires, poles, conduits, motors or other conductors or devices to conduct, convey, transmit, distribute, deliver, furnish or receive such electrical power or energy to or from any person at any place through, over, along or across any public highways, bridges, viaducts, railways, watercourses, or over or under any waters, and through, over or under the lands of any person, and to enter upon any lands upon either side of such lines or conduits, and fell or remove any trees or limbs thereof, or other obstructions, which, in the opinion of the Commission, it is necessary to fell or remove;

Taking power  
produced by  
companies.

- (c) To demand, order and direct the delivery to the Commission of the whole or any part of the product of the works of any company or person developing or which proposes to develop a water power or water privilege for the purpose of generating electrical power or energy in the Province of Ontario, or to enter into agreements with any such company or person for the supply of such product or any part thereof to the Commission for the purposes of this Act.

Application of  
Rev. Stat., c. 37.

**13.** Whenever the Lieutenant-Governor in Council shall authorize the Commission to enter into, take, use and expropriate the lands, works, plant, machinery, poles, wires and other property and appliances of any such company or person, or to take or expropriate the product of the works of any such company or person as aforesaid, or any portion thereof, the Commission shall have the powers, and shall proceed in the like manner as is provided in the case of the Minister of Public Works taking lands or property for the public uses of the Province of Ontario, and the provisions of *The Public Works Act* shall, *mutatis mutandis*, apply to the Commission acting under the authority of the Lieutenant-Governor in Council in such behalf.

Cost of works  
to be borne by  
municipalities.

**14.** The expenditure of the Commission upon any works, undertaken under the provisions of this Act, shall be repayable to the Commission by the municipal corporations entering into contracts with the Commission as hereinbefore authorized.

Annual pay-  
ments to be  
made by  
municipalities.

**15.** In addition to the price per horse power payable by any municipal corporation under the terms of a contract entered into with the Commission (which price shall include an allowance for generating, transforming and transmission losses) every municipal corporation entering into such a contract shall annually pay to the Commission its proportion of the following charges:

- (a) Interest at the rate of 4 per cent. upon the moneys expended by the Commission on capital account in the construction or purchase of the works, plant, machinery and appliances constructed or acquired by the Commission for the purpose of developing, transmitting and delivering electrical power or energy to such municipal corporation, and other municipalities, if any;
- (b) An annual sum sufficient to form in thirty years a sinking fund for the retirement of the securities issued by the Province of Ontario under this Act for the payment of the cost of the works hereinbefore mentioned;
- (c) The cost of operating, maintaining, repairing, renewing and insuring the said works, plant, machinery and appliances.

**16.** The Accountant of the Commission shall annually adjust and apportion the amounts payable by municipal corporations to the Commission under the next preceding section.

Apportionment of amounts payable by municipalities.

**17.** The Lieutenant-Governor in Council may from time to time raise by way of loan on the credit of the Province of Ontario as provided by the Act passed in the fifth year of His Majesty's reign, Chapter 2, such sums as may be required for the purposes hereinbefore mentioned, and the proceeds of every such loan may be paid over to the Commission for the purposes of this Act and be audited and accounted for in the manner provided by the Statutes of this Province respecting the management of the public revenue, and public accounts.

Government authorized to raise funds necessary for work of Commission.

**18.** All sums received by the Commission from municipal corporations, railway and other companies under this Act shall be duly accounted for by the Commission and shall be paid over to the Treasurer of the Province of Ontario, to be applied from time to time in the retirement of the securities given by the Province for any loan raised under this Act by the Lieutenant-Governor in Council.

Commission to account for moneys received, — application of same.

**19.—(1)** Upon the complaint in writing of any municipal corporation, company or person that any municipal corporation, company or person receiving power from the Commission under a contract as hereinbefore mentioned is charging for supplying electric lighting or heating or electric power or energy at a rate which is excessive or unfair, or that any municipal corporation is making use of the power conferred upon it by this Act for the purpose of granting bonuses by supplying power, light or heat below cost to manufacturers or others, the chairman of the Commission may appoint a time and place at which the Commission or some member thereof will hear and determine the matter in dispute.

Complaints as to rates charged by light, heat, power or gas companies, etc.

**(2)** Such notice of such appointment as the chairman may direct shall be given by the secretary of the Commission to all parties concerned. At the time and place appointed the Commission, or with the consent of all parties any member of the Commission, shall hear and determine the matter in dispute and shall make an order dismissing or

Hearing of complaints.



allowing the complaint and directing what rates shall be charged by the municipal corporation, company or person against whom the complaint is made, and regulating and determining the rates and charges to be imposed by such municipal corporation, company or person, and directing the amendment of any by-law or agreement accordingly.

Powers of Commission on enquiry.

(3) The Commission or the member thereof conducting the hearing shall have the powers authorized to be conferred upon a Commissioner appointed under *The Act respecting Enquiries Concerning Public Matters*.

Penalty for disobedience to order of Commission.

(4) Any such municipal corporation, company or person neglecting or refusing to obey and carry out the order or direction of the Commission or the member thereof conducting such case shall forfeit to His Majesty for the uses of the Province the sum of \$100 for every day during which such refusal or neglect shall continue.

Commission to report on water powers, etc., when required.

**20.** The Commission shall, whenever required by the Lieutenant-Governor in Council so to do, enquire into, examine and investigate water powers or water privileges in the Province and report to the Lieutenant-Governor in Council upon the value and capacity thereof, with such other information as the Lieutenant-Governor in Council may require. Every report of the Commission shall be laid before the Legislative Assembly at its next ensuing session.

No action to be brought against Commission without consent of Attorney-General.

**21.** No action shall be brought against the Commission or against any member thereof for anything done or omitted in the exercise of his office without the consent of the Attorney-General for Ontario.

Extent of powers of expropriation.

**22.** The powers of expropriation conferred by this Act shall extend to lands, works, rights, powers and privileges, notwithstanding that the same are or may be deemed to be devoted to a public use or that the owner thereof possesses the power of taking lands compulsorily.

During the year 1907, the Act under which your Commissioners were working was amended, and "An Act to provide for the Transmission of Electrical Power to Municipalities" (7 Edward VII., Chap. 19), was assented to by the Legislature on April 20th, 1907. A copy of this Act appears herewith:

## CHAPTER 19.

## An Act to provide for the Transmission of Electrical Power to Municipalities.

*Assented to 20th April, 1907.*

HIS MAJESTY, by and with the consent of the Legislative Assembly of the Province of Ontario, enacts as follows:—

1. This Act may be cited as *The Power Commission Act*.

Short Title.

2. For the purposes hereinafter mentioned, the Lieutenant-Governor in Council may from time to time appoint a Commission of three persons, two of whom may be members and one of whom shall be a member of the Executive Council, and The Commission shall be a body corporate under the name of "The Hydro-Electric Power Commission of Ontario," hereinafter called "The Commission." 6 Edw. VII. c. 15, s. 1.

Appointment  
of Hydro-  
Electric Power  
Commission.

3. The Lieutenant-Governor in Council may appoint one of the members to be Chairman of The Commission. Two members shall form a quorum. 6 Edw. VII. c. 15, s. 2.

Chairman.  
Quorum.

4. Every person appointed to The Commission shall hold office during pleasure, and the Lieutenant-Governor in Council, upon the death, resignation or removal from office of any member of The Commission, may appoint some other person to fill his place. 6 Edw. VII. c. 15, s. 3.

Tenure of  
office.

Vacancies.

5. The members of The Commission other than a member of the Executive Council shall be paid out of such moneys as may be voted by the Legislature for that purpose such salary or other remuneration as may be fixed by the Lieutenant-Governor in Council. 6 Edw. VII. c. 15, s. 4.

Salaries.

6. The Commission may appoint a Chief Engineer, an Accountant, and a Secretary, and such other engineers, accountants, officers, servants and workmen as may be deemed requisite. The salaries or other remuneration of the persons so appointed shall be fixed by The Commission subject to the ratification of the Lieutenant-Governor in Council and shall be payable out of such moneys as may be voted by the Legislature for that purpose. 6 Edw. VII. c. 15, s. 5.

Appointment  
of officers by  
Commission.

7. The Commission may from time to time, report to the Lieutenant-Governor in Council, designating the lands, waters, water privileges or water powers or the lands, works, machinery and plant, or portion thereof of any corporation or person owning or holding under lease or otherwise, or developing, operating or using a water privilege or water power, or transmitting electrical or other power or energy in Ontario which in the opinion of The Commission, should be purchased, acquired,

Report of  
Commission as  
to acquiring  
works, etc.

leased, taken, expropriated, developed, operated or used by The Commission for the purposes of this Act, or designating the quantity of the product of any corporation or person generating electrical power or energy in Ontario or bringing such power or energy into Ontario for use or transmission therein which The Commission requires for the purposes of this Act. 6 Edw. VII. c. 15, s. 11.

Authority may  
be given to  
Commission.

8. The Lieutenant-Governor in Council, upon the report of The Commission recommending the same, may authorize the Commission:—

To acquire  
lands and  
works.

- (a) To acquire by purchase, lease or otherwise, or without the consent of the owners thereof or persons interested therein to enter upon, take and use the lands, waters, water privileges, water powers, works, machinery and plant of any corporation or person owning, holding under lease or otherwise or developing, operating or using the same for generating or adapted for generating electrical power or energy or for the transmission thereof in Ontario; and to develop and use the same for any of the purposes of this Act.

Plant and  
property of  
transmission  
companies.

- (b) To construct, maintain and operate, and to acquire by purchase, lease or otherwise, or without the consent of the owners thereof or persons interested therein to enter upon, take, and use, all erections, machinery, plant, and other works and appliances for the transmission and supply of electrical power or energy, and to conduct, store, transmit and supply electrical power or energy for the purposes of this Act and with lines of wires, poles, conduits, motors or other conductors or devices to receive, conduct, convey, transmit, distribute, supply or furnish such electrical power or energy to or from any corporation or person at any place through, over, under, along, or across any lands, public highway, bridge, viaduct, railway, waters or watercourse, and through, over or under the lands of any corporation or person, and to enter upon any lands upon either side of such lines or conduits and fell or remove any tree or limb thereof, or obstruction, which, in the opinion of The Commission, it is necessary to fell or remove;

Contracting  
for supply of  
power to  
Commission.

- (c) To contract with any corporation or person generating, transmitting or distributing electrical power or energy or proposing so to do to supply electrical power or energy to The Commission; and to require any corporation or person generating, transmitting or distributing electrical power or energy to supply so much thereof as The Commission may require.

Powers of Com-  
mission as to  
expropriation;  
now exercised.

9. Whenever The Commission is authorized by the Lieutenant-Governor in Council to exercise any of the compulsory powers mentioned in section 8, The Commission in respect thereof shall have the powers



and shall proceed in the manner provided by *The Public Works Act*, Rev. Stat. c. 37. where the Minister of Public Works takes land or property for the use of the Province, and the provisions of the said Act shall *mutatis mutandis* apply.

**10.** The compulsory powers conferred by this Act shall extend to lands, works, rights, powers, privileges and property notwithstanding that the same are or may be deemed to be devoted to a public use or that the owner thereof possesses the powers of taking lands compulsorily. Extent of powers of expropriation.  
6 Edw. VII. c. 15, s. 22.

**11.** Whenever required by the Lieutenant-Governor in Council so to do, The Commission shall enquire into, examine and investigate water powers or water privileges in Ontario and report upon the value and capacity thereof, with such other information as the Lieutenant-Governor in Council may require. Every report of The Commission shall be laid before the Legislative Assembly at its next ensuing session. Commission to report on water powers, etc., when required.  
6 Edw. VII. c. 15, s. 20.

**12.** Any municipal corporation may apply to The Commission for the transmission and supply to the corporation of electrical power or energy for the use of the corporation and the inhabitants of the municipality for lighting, heating and power purposes or for any or either of such purposes or for any of the purposes mentioned in section 14, and The Commission shall thereupon furnish to the corporation a statement of the maximum price per horsepower at which the electrical power or energy will be supplied at the point of development or of its delivery to The Commission and an estimate of the cost of constructing or providing a transmission line by means of which the amount of electrical power or energy required by the corporation is to be supplied and of maintaining the same, and may furnish to the corporation plans and specifications of the works, plant, machinery and appliances necessary for the distribution of such power or energy by the corporation and an estimate of the cost thereof, and such other information as The Commission may deem advisable. The Council may thereupon enter into a provisional contract with The Commission for the supply of electrical power or energy for the purposes mentioned in this Act. Application to Commission for supply of power to municipal corporation.

**13.—(1)** The provisional contract shall not be binding upon the corporation unless and until a by-law approving the same has been submitted to and has received the assent in accordance with the provisions of *The Consolidated Municipal Act*, 1903, of the electors qualified to vote on by-laws for creating debts, and the estimates of The Commission or a summary thereof and a copy of the provisional contract shall be published with or form part of the by-law. Submission of provisional contract to ratepayers.

**(2)** After the provisional contract has received the assents of the electors and has been executed by the corporation and approved by the Lieutenant-Governor in Council, The Commission may carry out and execute the same and shall have power and authority to do all acts necessary for that purpose. Execution of contract.

Powers of contracting municipality as to supplying light, heat and power.

**14.—**(1) In addition to the powers conferred by this Act, a municipal corporation which has entered into a contract with The Commission for the supply of electrical power or energy shall have and may exercise in respect of such power or energy all the powers which are by *The Municipal Light and Heat Act* or *The Consolidated Municipal Act, 1903*, conferred upon corporations in respect to light and heat, and all the powers which are conferred upon corporations by the said last mentioned Act for contracting debts for any purpose within the jurisdiction of the council thereof and also the power to expropriate land, making compensation therefor, under the provisions of the said last mentioned Act.

Submission of money by-laws with contract.

(2) The council of a municipal corporation, if they shall see fit, may submit a by-law for raising the money required for any of the purposes mentioned or referred to in sub-section 1, at the same time as the provisional contract is submitted to the electors under the provisions of section 13.

Supplying power outside of municipality.

(3) A municipal corporation which has entered into a contract with The Commission under this Act may from time to time, with the approval of The Commission, contract with any other municipal corporation or with any person or corporation for the supply or distribution of electrical power or energy in any other municipality, and such other municipal corporation shall have authority to enter into the contract; but a municipal corporation shall not exercise the power conferred by this section in another municipality without the consent of the council thereof.

3 Edw. VII., c. 19, s. 566, par 4, clause (a) and secs. 567a and 567b not to apply.

**15.** For greater certainty it is hereby declared that clauses lettered (a) to (a9), both inclusive, following paragraph 4 of section 566 and sections 567a and 567b of *The Consolidated Municipal Act, 1903*, shall not apply to any municipal corporation which has entered into a contract with The Commission or to any by-law which shall be submitted to the electors under the provisions of this Act.

Supplying power to railways and distributing companies.

**16.—**(1) The Commission may, subject to the approval of the Lieutenant-Governor in Council, contract from time to time with a railway company or a distributing company or with any other corporation or person for the supply of electrical power or energy.

Profits to be applied in reducing cost of maintenance to municipalities.

(2) Any net profit made by The Commission in supplying power under the next preceding sub-section after making provision for the cost of acquiring or constructing and of maintaining the works by means of which the power or energy is supplied, shall be applied in payment of the cost of maintaining the works acquired or constructed and operated by The Commission.

Agreements for use of right of way of railway companies.

(3) The Commission may, from time to time, with the approval of the Lieutenant-Governor in Council, contract with a railway company or power or transmission company for the use of its right of way and property for the erection of works and other constructions for transmitting electrical power or energy. 6 Edw. VII. c. 15, s. 9.

**17.** The expenditure of The Commission upon any works, undertaken under the provisions of this Act, shall be repayable to The Commission by the municipal corporations which have entered into contracts with The Commission. 6 Edw. VII. c. 15, s. 14.

Cost of works to be borne by municipalities.

**18.** In addition to the price per horse power payable by any municipal corporation under the terms of a contract entered into with The Commission, which shall be the cost of the power to The Commission at the point of development, or of its delivery to The Commission, the corporation shall annually pay to The Commission its proportion as adjusted by The Commission of the following charges:—

Additional annual payments.

(a) Interest at the rate of 4 per cent. upon the moneys expended by The Commission on capital account in the construction or purchase of the works.

(b) An annual sum sufficient to form in thirty years a sinking fund for the retirement of the securities issued by the Province under this Act for the payment of the cost of the works; and

(c) Line loss and the cost of operating, maintaining, repairing, renewing and insuring the works.

**19.** The Commission shall annually adjust and apportion the amounts payable by municipal corporations under the next preceding section. 6 Edw. VII. c. 15, s. 16.

Apportionment of amounts payable by municipalities.

**20.** The Lieutenant-Governor in Council may from time to time raise by way of loan on the credit of the Province in the manner provided by the Act passed in the fifth year of His Majesty's reign, Chaptered 2, such sums as the Lieutenant-Governor in Council may deem requisite for the purposes of this Act, and such sums may be paid over to The Commission and shall be accounted for and audited in the manner provided with respect to the management of the public revenue and public accounts. 6 Edw. VII. c. 15, s. 17.

Government authorized to raise funds necessary for work of Commission.

**21.** All sums received by The Commission shall be accounted for and paid over to the Treasurer of the Province, to be applied from time to time in the retirement of the securities given by the Province for any debt incurred under the authority of this Act. 6 Edw. VII. c. 15, s. 18.

Commission to account for moneys received—application of same.

**22.—(1)** Upon the complaint in writing of any municipal corporation, company or person that any municipal corporation, company or person, receiving power from The Commission is charging for electric lighting or heating or for electrical power or energy a rate which is excessive or unfair, or that any municipal corporation is making use of the power conferred upon it by this Act for the purpose of granting a bonus by supplying power, light or heat below cost to manufacturers or others, the chairman of The Commission may appoint a time and place at which The Commission or some member thereof will hear and determine the matter of the complaint.

Complaints as to rates charged for light, heat or power.



Hearing of  
Complaints.

(2) Such notice of the appointment as the Chairman, may direct shall be given by the Secretary of The Commission to such persons as the Chairman may direct. At the time and place appointed The Commission or member thereof shall hear and determine the matter of the complaint and may dismiss or allow the complaint and may direct what rates shall be charged, and may regulate and determine the rates to be charged and may direct the amendment of any by-law or agreement accordingly, or may make such order as may seem meet.

Powers of Com-  
mission on  
enquiry.

(3) The Commission or the member thereof hearing the complaint shall have all the powers that may be conferred upon a Commissioner appointed under *The Act respecting Enquiries concerning Public Matters*.

Penalty for  
disobedience  
to order of  
Commission.

(4) Any municipal corporation, company or person neglecting or refusing to obey and carry out the order or direction of The Commission or the member thereof before whom the complaint was heard in addition to any other liability shall forfeit to His Majesty for the uses of the Province the sum of \$100 for every day during which such refusal or neglect shall continue. 6 Edw. VII. c. 15, s. 19.

No action to be  
brought against  
Commission  
without  
consent of  
Attorney-  
General.

**23.** Without the consent of the Attorney-General, no action shall be brought against The Commission or against any member thereof for anything done or omitted in the exercise of his office. 6 Edw. VII. c. 15, s. 21.

Non-liability  
for errors in  
estimates, etc.

**24.** Neither the Province nor The Commission nor any member thereof shall incur any liability by reason of any error or omission in any estimates, plans or specifications prepared or furnished by The Commission.

6 Edw. VII., c.  
15 repealed.

**25.—**(1) The Act passed in the 6th year of His Majesty's reign, Chaptered 15, is hereby repealed, but the repeal thereof shall not affect the matters and things mentioned in section 8 of Chapter 3 of the Revised Statutes of Ontario, 1897, which shall apply to this Act.

Contracts  
already  
authorized.

(2) Any contract which might have been entered into under the authority of the repealed Act may be entered into after the passing of this Act with the same effect and in the same way as if the first mentioned Act had not been repealed.

During the year 1908 The Commission received resolutions passed by the various Councils of the municipalities who had made contracts with The Commission for electric power, asking that the Legislature validate all proceedings, by-laws and contracts in connection with these contracts. In accordance with this united request the Legislature passed an Act to validate certain by-laws passed and contracts made pursuant to "An Act to Provide for the Transmission of Electrical Power to Municipalities." A copy of this Validatory Act is produced herewith.



No. 238.

1908

## BILL

An Act to validate certain By-laws Passed and Contracts made pursuant to "An Act to Provide for the Transmission of Electrical Power to Municipalities."

HIS MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:—

1. The By-laws passed by the Municipal Corporation of the Cities of Toronto, Hamilton, London, Brantford, Guelph, Stratford, St. Thomas, Woodstock; the Towns of Ingersoll, Berlin, Galt, Toronto Junction, Hespeler, St. Marys, Preston, Paris and Waterloo, and the Villages of New Hamburg and Weston, purporting to authorize the said Corporations or the Councils thereof, respectively, to enter into a contract with the Hydro-Electric Power Commission of Ontario for a supply of electrical power to be transmitted from Niagara Falls, and the estimates therein set forth, if any, are declared to be, in form and in substance, a sufficient compliance with the provisions of the Act entitled *An Act to provide for the Transmission of Electrical Power to Municipalities*; and the said by-laws are hereby confirmed and declared to be sufficient, legal, valid and binding for the purposes thereof.

2. The by-laws passed by the said Corporations or any of them for the issue of debentures to provide for the construction of a plant to distribute the said power within the limits of the said Corporations and all debentures to be issued thereunder and all assessments to be made and rates to be levied are hereby confirmed and declared to be valid.

3. The contracts set out as Schedules "A" hereto between the said Commission and the Ontario Power Company of Niagara Falls are hereby confirmed and declared to be legal and valid.

4. The form of contract set forth as Schedule "B" hereto between the said Commission and the said Corporations is declared to be a sufficient compliance with the provisions of the said Act, and the said Corporations, or any of them, are authorized and empowered to enter into a contract with the said Commission in said form, or with such additions and alterations as may be approved of by the Lieutenant-Governor in Council; and when executed the said contract shall be legal, valid, and binding on the parties thereto for the purposes of the said Act.

## SCHEDULE "A."

This Agreement made the nineteenth day of March, 1908, between The Hydro-Electric Power Commission of Ontario, acting herein on its own behalf and with the approval of the Lieutenant-Governor in Council (hereinafter called the "Commission") party of the First Part, and The Ontario Power Company of Niagara Falls (hereinafter called the "Company"), party of the Second part.

Whereas the Commission invited tenders for electric power to be supplied at or near the Niagara Falls, and the Company made the lowest tender for the supply of power to the Commission for their purposes under the provisions of the Power Commission Act.

And whereas certain municipalities have applied to the Commission for the maximum price of such power at Niagara Falls and for estimates of the cost of transmission to the said municipalities;

And whereas the estimates of the Commission will be based in part upon this agreement, and the Commission will be required to devote time and skill and expend moneys in the preparation of such estimates, and such estimates are to be used by said municipalities for the purposes fully set forth in the said Act;

And whereas the Commission declined other tenders and accepted the tender of the Company and entered into the agreement hereto attached, but it was provided that certain additions might be made to the said agreement, and the parties have agreed to vary the said agreement in the manner hereinafter set forth;

Now therefore this Indenture witnesseth that in consideration of the premises and of the mutual covenants and agreements herein contained, the parties hereto have mutually agreed and do each agree with the other as follows:—

1. That, except in so far as the said agreement is modified by this present agreement the same shall stand and be of full force, virtue and effect and binding between the parties.

2. The Company hereby agrees:—

(a) At the expiration of ninety days' notice in writing by the Commission to the Company to deliver eight thousand (8,000) horse power or more of electric power to the Commission.

(b) At the expiration of three months' like notice which may be given from time to time during the continuance of this agreement to deliver from time to time to the Commission in blocks of not less than one thousand (1,000) horse power each, additional electric power until the total amount so delivered shall amount to thirty thousand (30,000) horse power.

(c) At the expiration of nine months' like notice, which may be given from time to time during the continuance of this agreement, to deliver from time to time to the Commission in like blocks, additional electric power until the total so delivered shall amount to one hundred thousand (100,000) horse power.

(d) The Commission shall not be bound to take or pay for any electric power until notice shall have been given as above provided.

(e) The Commission agrees to use all diligence by every lawful means in its power to procure such a demand from the municipalities, corporations, companies or persons for the power dealt with by this agreement so that at as early a date as possible the Commission will be in a position to give the notice above referred to the Company for the supply of power in question, and if notwithstanding the exercise of all such reasonable diligence the Commission is not able within a period of eighteen months from the date of this agreement to give such notice, then the Company shall be at liberty to determine the agreement and it shall thereupon be no longer binding upon the parties hereto.

(f) The Commission agrees to take power exclusively from the Company up to the said 30,000 horse power, and also in addition thereto one-half of the amount of power required by the Commission up to the said 100,000 horse power; thereafter the Commission may, at its option, take power from other sources.

3. The Company hereby agrees to deliver, and the Commission agrees to purchase and pay for the said several quantities of electric power on the terms and conditions of this agreement.

4. The Commission hereby agrees to pay to the Company for such power so delivered under the terms of this agreement at the rate of \$9.40 per horse power per annum for power at 12,000 volts, and at the rate of \$10.40 per horse power per annum for power at 60,000 volts, and when the amount reserved and held ready for delivery upon the order of the Commission is in all, 25,000 horse power or more, payment shall be made at the rate of \$9.00 per horse power or more per annum for power at 12,000 volts, and at the rate of \$10.00 per horse power per annum for power at 60,000 volts. If power is taken at a higher voltage than 60,000 volts the price shall be determined as hereinafter provided. The power shall be paid for monthly in gold coin of the present standard of weight and fineness in twelve amounts in each year

at the office of the Company at Niagara Falls, Ontario, and bills shall be rendered by the Company on the first and paid by the Commission on or before the fifteenth of each month.

5. The Commission shall pay for three-fourths of the power ordered by the Commission and held in reserve for it as herein provided whether it takes the same or not.

6. When the greatest amount of power taken for any twenty consecutive minutes during any month shall exceed three-fourths of the amount during such twenty consecutive minutes ordered by the Commission and held in reserve then the Commission shall pay for this greater amount during that entire month.

7. The point of delivery shall be the property line between the Company's distributing station and the right of way of the Michigan Central Railway at Niagara Falls, Ontario, Canada, and at or near this point on the Company's land the Commission shall have the right to erect and maintain during the continuance of this agreement its initial line structure or structures.

8. This agreement shall remain in force for ten years from the date of the expiration of the said ninety days' notice. The Commission may, at its option, continue this agreement for one, two or three further consecutive terms of ten years each by giving notice in writing of its intention to continue this agreement for the second term of ten years, at least three years before the expiration of the first term of ten years, and if pursuant to such notice this agreement is continued, by giving notice of its intention to continue this agreement for the third period of ten years at least three years before the expiration of the second term of ten years, and if pursuant to such last mentioned notice this agreement is continued, by giving notice of its intention to continue this agreement for the fourth term of ten years at least three years before the expiration of the third term of ten years. This agreement shall not in any event extend beyond the 1st of April, 1950, the date at which the first term of years of an agreement of the Company with the Commissioners of the Queen Victoria Niagara Falls Park dated eleventh April, 1900, will expire.

9. The electric power herein contracted for shall be three phase, alternating, commercially continuous twenty-four hour power every day of the year except as provided in paragraph 17 hereof.

10. It is agreed that the maintenance by the Company of approximately the agreed voltage at approximately the agreed frequency at the line switch or switches of the Company shall constitute the delivery of all power involved herein and the fulfilment of all operating obligations hereunder; and that when voltage and frequency are so maintained the amount of the power, its fluctuations load factor, power factor, distribution as to phases, and all other electric characteristics and qualities are under the sole control of the Commission, its agents, customers, apparatus, appliances and circuit.

11. The several blocks of power herein provided for shall be the amounts which the Company shall from time to time hold in reserve upon the order of the Commission and the Commission shall not at any time take more than the amount so ordered and held in reserve for it.

12. The Commission shall so take power that the kilo volt amperes so taken shall not at any time exceed by more than ten per cent. the kilowatts held in reserve for it and this provision shall apply proportionately to each circuit and phase.

13. The Company shall at all times use first-class, modern standard, commercial, hydro-electric power apparatus and plant and the power shall be delivered at approximately 12,000 volts or approximately 60,000 volts unless otherwise agreed as hereinafter provided, and at approximately 25 cycles per second, the Company shall use first-class, modern, standard regulating apparatus and all due skill and diligence to maintain the power at such voltage and frequency. The Commission may require part of the said power to be delivered at more than 60,000 volts and the Company shall be entitled to have the price for such higher voltage increased to such an extent as shall be relatively the equivalent, but without increased profit, to the price of power delivered at 60,000 volts, and in case the Company and the Commission cannot fix the higher voltage and the price to be paid therefor, the voltage may be fixed and the price to be paid determined under *The Arbitration Act*, Revised Statutes of Ontario, 1897, Chapter 62, in a summary manner and without appeal. Notwithstanding any award the Commission may decide to take power at 12,000 or 60,000 volts, but in that event the Commission shall pay all costs of said arbitration. The Commission shall with the ninety days' notice before mentioned specify in writing to the Company that the power



is to be delivered at not more than two of the said voltages or partly at one of the two and partly at the other voltage, and the Company shall deliver power or at the same time a certain part of the power at one voltage, and a certain part at the other so specified. The Commission may from time to time vary the quantities to be delivered at the specified voltages and thereupon the Company shall deliver the said power as varied, but the price for the power specified at the higher voltage shall not be reduced if the power is taken at the lower voltage. If part of the power is specified at a voltage higher than 60,000 volts the Commission shall give one year's notice instead of ninety days' notice for that part of such power.

14. The Commission and its customers shall select and use transformers and all apparatus most suitable to receive the electric power produced by the apparatus of the Company and the Commission's transmitting, transforming, translating and all other apparatus and devices upon its circuits when receiving power from the Company shall be of modern, standard design and construction and shall be operated and maintained with special reference to securing the highest efficiency and most perfect operation not only of its own but also of the apparatus of the Company when receiving power from the Company; and the Commission shall install upon and equip all circuits with such approved protective devices as are in commercial use and operate its circuits in such a manner as will to the then greatest extent protect the apparatus and circuits of the Company from damage and interruption by lightning, short-circuiting or otherwise so as to save harmless the Company from any damage that may arise in the use of the said power supplied by the Company to the said Commission.

After the happening of any of the events provided for in paragraphs 17 and 22, power shall be delivered first to the Commission before re-establishing power to any other customer or customers of the Power Company, provided that the Commission's lines are ready to receive such power.

15. The power herein provided for shall be measured by curve-drawing meters. These meters shall be subject to test as to accuracy by either party hereto.

16. The engineers of the Commission, or one or more of them, or any other person or persons appointed for this purpose by the Commission, shall have the right from time to time during the continuance of this agreement to inspect the apparatus, plant and property of the Company and take records at all reasonable hours on giving to the Company six hours' notice of the intention to make such inspection. The Company shall have a like right on giving a like notice to inspect the apparatus, plant and property of the Commission and of the municipalities, companies and persons who are using power supplied by it through or to the Commission.

17. In case the Company shall at any time or times be prevented from delivering said power, or any part thereof, or in case the Commission shall at any time be prevented from taking said power, or any part thereof, by strike, lock-out, riot, fire, invasion, explosion, act of God or the King's enemies, or any other cause reasonably beyond their control, then the Company shall not be bound to deliver such power during such time and the Commission shall not be bound to pay for such power during such time but as soon as the cause of such interruption is removed the Company shall without any delay deliver the said power as aforesaid and the Commission shall take the same and each of the parties hereto shall be prompt and diligent in removing and overcoming such cause or causes of interruption.

18. If and so often as any interruption shall occur in the service of the Company due to any cause or causes other than those provided for by the next preceding paragraph hereof, the Company shall pay to the Commission as liquidated and ascertained damages, and not by way of penalty, as follows:—For any interruption less than one hour double the amount payable for power which should have been delivered during the time of such interruption, and for any interruption of one hour or more, the amount payable for the power which should have been delivered during the time of such interruption and twelve times the last mentioned amount in addition thereto and all moneys payable under this paragraph when the amount thereof is settled between the parties may be deducted from any moneys payable by the Commission to the Company under this agreement, but such right of deduction shall not in any case delay the monthly payments for power contracted for by this agreement.

19. It is recognized by both the parties hereto that the state of the art of production, transmission and application of electric energy is subject to constant advance and that it is impossible by contract to cover all the



requirements and conditions which time may develop; the Company and the Commission with the approval of the Lieutenant-Governor in Council while adhering to the provisions of this agreement will at any time upon the request of the other take up and in good faith fairly consider with the aid of the respective engineers any features or changes of the system as a whole or any modifications of any of the provisions hereof provided it shall appear to the party to whom such request is made that compliance therewith shall tend to make this agreement more effective and to make the venture of each party more successful and certain; provided, however, that any such action or the failure on the part of either party to require of the other exact conformity to the provisions of this agreement, or any liberty or greater latitude beyond the provisions of this agreement allowed by either party to the other in the course of the co-operation implied by the spirit of this agreement shall in no manner operate as or constitute a precedent or amend or change the obligation of the parties thereto.

20. This agreement is entered into subject to the provisions of *The Power Commission Act* and neither the making of this agreement nor anything herein contained shall in any way limit or prejudice any rights and powers which the Commission may now have to expropriate the plant and apparatus of the said Company or any plant thereof or the power generated by the said Power Company or any other power company, but nothing in this agreement shall be taken to give or enlarge any such power.

21. It is agreed that in case any dispute shall arise relating to the question of the performance and fulfilment of any of the terms, provisoes or conditions of this agreement, or as to the method or accuracy of the measurement of the power, or as to any question which may arise under this agreement, or as to the rights of any of the parties after the termination of this agreement, under paragraph 22, the same shall be determined by two independent persons, one to be chosen by each of the parties to such dispute, and such persons before proceeding with the reference shall appoint a third arbitrator to act with them, and the decision of the said three arbitrators, or a majority of them, shall be conclusive on both parties except as herein-after provided, and in case either of the said parties shall neglect or fail to appoint an arbitrator within thirty days after the request in writing by the other party then the arbitrator appointed by the other party may proceed alone and his award shall be conclusive on both parties except as herein-after provided. The award shall be made within four months after the appointment of the first of such arbitrators, and in the event of the two arbitrators appointed as aforesaid being unable or unwilling to agree upon a third arbitrator for two weeks after their appointment or the appointment of the one of them who was last appointed, then said third arbitrator shall be chosen and appointed by the Chief Justice for the time being of the King's Bench, Division of the High Court of Justice for the Province of Ontario, or in the event of the said Chief Justice being ill, absent from the Province or otherwise unable or refusing to act, then such third arbitrator shall be appointed by any Judge of the High Court of Justice, or any Judge other than a local Judge. It is agreed that there may be an appeal by either party from any decision or award of such arbitrators to the High Court of Justice for Ontario in accordance with the provisions of *The Arbitration Act* in that behalf.

22. In case the plant, apparatus, buildings or premises of the Company, or any part thereof, shall at any time during the continuance of this agreement be damaged or destroyed so as to prevent the Company from supplying the said power of the quantity and quality hereinbefore provided for to the Commission the Company shall use its best endeavor to procure the said supply of power for the Commission otherwise or elsewhere and if the Company fails or neglects to procure such power for the Commission then the Commission may, with the approval of the Lieutenant-Governor in Council, procure such power at reasonable rates and charge the same to the Company; and if the said power cannot be procured either by the Company or the Commission then the Commission may, with the approval of the Lieutenant-Governor in Council, terminate this agreement.

23. If at any time that the quantity of power which is being taken under this agreement by the Commission shall amount to sixty per cent. or more of the total power which the Company is developing and a complaint is then made in writing by the Commission to the Company that the Company has so continuously neglected or failed to perform the terms of this agreement that the apparatus of the Commission or its customers cannot by reason of such neglect or failure of the Company be operated to full efficiency and the Company shall not within a reasonable time remedy such

neglect or failure, then the matter of complaint may be referred to the Lieutenant-Governor in Council, and if he determine that there is a just ground of complaint he may direct that the Company shall remedy such neglect or failure within a time to be fixed by him, and if such neglect or failure be not remedied as directed by him the Lieutenant-Governor in Council may order that upon such terms as he deem reasonable including the rights of other parties interested, the whole of the plant, apparatus and property of the Company shall be transferred to the Commission, whereupon, on payment and satisfaction of the said terms the amount of which payment and satisfaction is to be settled by the arbitrators appointed as hereinbefore stated, the Commission may, with the approval of the Lieutenant-Governor in Council take over the plant, apparatus and property and the same shall be transferred to the Commission.

24. The Company agrees with the Commission that the Company will not, during the continuance of this agreement, exercise the right to cancel the agreement dated 11th April, 1900, between the Company and the Commissioners of the Queen Victoria Niagara Falls Park.

25. In case any municipal corporation which shall contract with the Commission for a supply of power or any person, firm or Corporation which shall contract with any such municipal Corporation, or with the Commission for a supply of power furnished to the Commission by the Company, shall suffer damages by the act or neglect of the Company, and such municipal Corporation, person, firm, or corporation would, if the Company had made this contract directly with them, have had a right to recover such damages or commence any proceedings or any other remedy the Commission shall be entitled to commence any such proceedings or bring such action for or on behalf of such municipal Corporation, person, firm or corporation, and notwithstanding any acts, decision or rule of law to the contrary the Commission shall be entitled to all the rights and remedies of such municipal Corporation, person, firm or corporation including the right to recover such damages, but no action shall be brought by the Commission until such municipal Corporation, person, firm or corporation shall have agreed with the Commission to pay any costs that may be adjudged to be paid if such proceeding or action is unsuccessful. The rights and remedies of any such municipal Corporation, person, firm or Corporation shall not be hereby prejudiced.

26. Subject to the provisions of paragraphs 22 and 23 of this agreement, notwithstanding there may be differences between the parties hereto as to the supply of sufficiency of the said power or the payment therefor or any other questions whatever which may arise under this agreement, the Company shall continue to deliver the power and the Commission to pay therefor and both parties shall continue to carry out the contract notwithstanding such differences; and when the matters which may be so in issue shall be finally determined by the reference to arbitration in the manner provided by paragraph 21 hereof, the parties shall deal with such matters according to the terms of the award which may be made upon such reference. It being the distinct agreement between the parties that there shall not be during the period of this agreement any stoppage or cessation in the supply of the said power or on the payments therefor but that the same shall be continued as if there was no such difference.

27. The Company shall not directly or indirectly deliver power in Ontario to any person or Corporation that it is intended shall be supplied by the Commission under this agreement. In case any difference arises as to the said supply the same shall be settled with the said arbitrators. This paragraph shall not be held to cover or interfere with the supply of power agreed to be delivered by the said Company to any persons or Corporations other than the Commission at the date on which the first block of power is ordered by the Commission from the Company under this agreement, but the said supply of power shall continue unaffected by this agreement. The Commission agrees it will not supply power at less than 60,000 volts at a price less than the price herein provided for power at 60,000 volts with the cost of transforming added thereto any person or Corporation in the territory supplied from the transmission lines of the Company at the rate at which the first block of power is ordered by the Commission from the Company under this agreement. In case any difference arises as to the extent of such territory the same shall be settled by said arbitrators.

28. This agreement shall extend to, be binding upon and enure to the benefit of the successors and assigns of the parties hereto.

29. Notwithstanding anything hereinbefore contained this agreement shall not come into operation as against the Commission or be binding upon the



Commission until, in addition to any other Orders in Council, pursuant to said Act, an Order in Council has been passed and approved by the Lieutenant-Governor in Council expressly declaring that this agreement shall, from the date of such Order in Council, be binding upon the Commission, but this shall in no way interfere with the agreement contained in paragraph 2 (e) and the Commission undertakes to do all things lawful in its power that may be needed to bring this agreement into operation at as early a date as possible and to procure the assent and declaration of the said Lieutenant-Governor in Council above referred to and the said Company agrees to co-operate with the Commission by all lawful means in its power to carry out the object of this agreement.

In witness whereof the said Commission has affixed its corporate seal and has signed, sealed and executed the present agreement; and the Company by and through its President and Secretary duly authorized for all purposes hereof has hereunto affixed its corporate seal under the hands of its President and Secretary.

A. BECK,  
JOHN S. HENDRIE.  
W. K. McNAUGHT.

(Seal.)

THE ONTARIO POWER COMPANY OF NIAGARA FALLS.

J. J. ALBRIGHT,  
*President.*

(Seal.)

ROBERT C. BOARD,  
*Secretary.*

This Agreement made this 12th day of August, 1907, between The Hydro-Electric Power Commission of Ontario, acting herein on its own behalf, and with the approval of the Lieutenant-Governor in Council (hereinafter called the "Commission"), party of the First Part, and The Ontario Power Company of Niagara Falls, incorporated by the Parliament of the Dominion of Canada, under and by virtue of Act, 1887, 50-51 Victoria, Chapter 120; Act, 1891, 54-55 Victoria, Chapter 126; Act, 1893, 56 Victoria, Chapter 89; Act, 1899, 62-63 Victoria, Chapter 105; Act, 1900, 63-64 Victoria, Chapter 115, and Act, 1902, 2 Edward VII, Chapter 86 (hereinafter called the "Company"), party of the Second Part.

Whereas, the Commission is duly incorporated under the provisions of an Act passed by the Legislature of the Province of Ontario, in the sixth year of His Majesty King Edward VII., and Chaptered 15, and under the provisions of said Act is authorized to contract with any Company generating electrical power or energy for a supply of electrical power or energy to the Commission:

And whereas, the Company, under the provisions of the Statutes of Canada, above recited, and under the provisions of certain agreements dated April 11, 1900, August 15, 1901, June 28, 1902, and February 28, 1903, between the Company and the Commissioners of the Queen Victoria Niagara Falls Park, to which agreements reference is specifically made, has constructed a series of works in the vicinity of Niagara Falls, Ontario, in which the Company is now generating electrical power, and is prepared to sell and deliver the same in the quantities hereafter mentioned;

And whereas, the Commission invited tenders for electric power to be supplied at or near the Niagara Falls, and the Company made the lowest tender for the supply of power to the Commission for their purposes under the provisions of the said Act;

And whereas, certain municipalities have applied to the Commission for the maximum price of such power at Niagara Falls, and for estimates of the cost of transmission to the said municipalities;

And whereas, the estimates of the Commission will be based in part upon this agreement, and the Commission will be required to devote time and skill and expend moneys in the preparation of such estimates, and such estimates are to be used by said municipalities for the purposes fully set forth in said Act;





9. The several blocks of power herein provided for shall be the amounts which the Company shall from time to time hold in reserve ready for the Commission, and the Commission shall not at any time take more than the amount so held in reserve for it.

The Commission shall so take power that the kilo-volt amperes so taken shall not at any time exceed by more than 5 per cent. the kilowatts held in reserve for it, and this provision shall apply proportionately to each circuit and phase.

10. The power herein provided for shall be measured by curve-drawing meters. These meters shall be subject to test as to accuracy by either party hereto.

The Commission shall pay for three-fourths of the power held in reserve for it, as herein provided, whether it takes the same or not.

When the greatest amount of power taken for any twenty (20) consecutive minutes during any month shall exceed three-fourths of the amount at that time held in reserve for the Commission, then it shall pay for this greater amount during that entire month.

11. The point of delivery shall be the property-line between the Company's Distributing Station and the right of way of the Michigan Central R.R. at Niagara Falls, Ontario, Canada, and at this point the Commission shall have the right to erect and maintain its initial line structure or structures.

12. In case the Company shall be prevented from delivering said power, or in case the Commission shall be prevented from taking said power, by strike, lock-out, riot, fire, invasion, explosion, act of God, or the King's enemies, or any other cause reasonably beyond their control, then the Company shall not be obligated to deliver such power during such period; and the Commission shall not be obligated to pay for such power during such period; but nothing herein contained shall be construed as permitting the Company to refuse to deliver power, or the Commission to refuse to take the same as soon as the cause of interruption is removed, and each of the parties hereto shall be prompt and diligent in removing and overcoming such cause or causes.

13. If interruptions occur in the service of the Company due to causes other than above, deductions shall be made as follows:—For interruptions less than one hour, double the amount payable for power for the time of such default, and for interruptions of one hour or more, the amount otherwise payable for the day.

14. The Commission and its customers shall select and use transformers and all apparatus most suitable to receive the electric power produced by the apparatus of the Company, and the Commission's transmitting, transforming, translating and all other apparatus and devices upon its circuits shall be of standard design and construction and shall be operated and maintained with special reference to securing the highest efficiency and most perfect operation, not only of its own, but also of the apparatus of the Company when receiving power from the Company; and the Commission shall install upon and equip its circuits with such approved protective devices as are in commercial use and operate its circuits in such a manner as will to the then greatest extent protect the apparatus and circuits of the Company from damage and interruption by lightning, short circuiting or otherwise, so as to save harmless the Company from any damage that may arise in the use of the said power supplied by the Company to the said Commission.

After the happening of any of the events provided for in paragraphs 12 and 13 power shall be delivered first to the Commission before re-establishing power to any other customer or customers of the Power Company, provided that the Commission's lines are ready to receive such power.

15. It is recognized by both the parties hereto that the state of the art or production and transmission and application of electrical energy is subject to constant advance, and that it is impossible by contract to cover all requirements and conditions which time may develop, and the Company and the Commission with the approval of the Lieutenant-Governor-in-Council while adhering to the provisions of this agreement, will at any time upon the request of the other, take up and in good faith fairly consider, with the aid of their respective engineers, any features or changes of the system as a whole of the modifications of any of the provisions hereof, provided it shall appear to the party to whom such request is made that compliance therewith shall tend to make this agreement more effective and to make the venture of each party more successful and certain; provided, however, that any such action, or the failure on the part of either party to require of the other exact conformity to the provisions hereof, or any liberty or greater

latitude beyond the provisions of this agreement permitted by either party to the other, in the course of the co-operation implied by the spirit of this agreement, shall in no manner act as or constitute a precedent or amend or change the obligations of the parties hereto.

16. The Commission hereby agrees to pay to the Company for such power delivered under the terms of this agreement, the sum of ten dollars and forty cents (\$10.40) per horse power per annum when the amount reserved and held ready upon the order of the Commission, for delivery under the terms hereof, is less than twenty-five thousand (25,000) horse power, and when the amount reserved and held ready for delivery upon like order exceeds twenty-five thousand (25,000) horse power, the Commission agrees to pay the sum of ten dollars (\$10.00) per horse power per annum. The power shall be paid for monthly in gold coin of the present standard of weight and fineness, in twelve amounts, in each year at the office of the Company in Niagara Falls, Ontario, and bills shall be rendered for such payments on the first, and be paid on or before the fifteenth of each month.

17. At any time that the quantity of power which is being taken under this agreement by the Commission shall amount to sixty per cent. or more, of the total power which the Company is developing and a complaint is then made in writing by the Commission to the Company that the Company has so continuously neglected or failed to perform the terms of this agreement that the apparatus of the Commission or its customers cannot by reason of such neglect or failure of the Company be operated to full efficiency and the Company shall not within a reasonable time remedy such neglect or failure then the matter of complaint may be referred to the arbitrators appointed as hereinafter stated, and if the said arbitrators shall determine that there is a just ground of complaint they may by their award direct that the Company shall remedy such neglect or failure within a time to be fixed by the award, and if such neglect or failure be not remedied as directed by the said award the arbitrators may order that upon such terms as they deem reasonable including the rights of the other parties interested the whole of the plant apparatus and property of the Company shall be transferred to the Commission, whereupon on payment and satisfaction of the said terms the Commission may, with the approval of the Lieutenant-Governor-in-Council, take over said plant, apparatus and property, and the same shall be transferred to the Commission.

18. It is hereby declared and agreed that in case the plant, apparatus, buildings or premises of the Company or any part thereof shall at any time during the continuance of this agreement be damaged or destroyed so as to prevent the Company from supplying the said power of the quantity and quality hereinbefore provided for to the Commission and the Company is unable to supply the said power within a reasonable time to be fixed if necessary by the said arbitrators, the Commission may, with the approval of the Lieutenant-Governor in Council, terminate this agreement, and any questions as to terms of conditions connected with such determination of the agreement shall be settled by the said arbitrators.

19. It is further agreed by and between the parties hereto that, in case any dispute shall arise relating to the question of the performance or fulfilment of any of the terms provisos or conditions of this agreement, or as to the method or accuracy of the measurement of the power or as to any other question which may arise under this agreement, the same shall be finally determined by two independent persons, one to be chosen by each of the parties to such dispute, and such arbitrators shall, before proceeding with the reference, appoint a third arbitrator to act with them, and the decision of the said three arbitrators or a majority of them shall be conclusive on both parties, and in case either of the said parties shall neglect or fail to appoint an arbitrator within thirty days after the request in writing by the other party, then the arbitrator appointed by the other party may proceed alone, and his award shall be conclusive on all parties. The award shall be made within four months after the appointment of the first of such arbitrators and, in the event of the two arbitrators appointed, as aforesaid, being unable or unwilling to agree upon a third arbitrator for two weeks after their appointment or the appointment of the one of them who was last appointed then such third arbitrator shall be chosen and appointed by the Chief Justice for the time being of the King's Bench Division of the High Court of Justice for the Province of Ontario or in the event of the Chief Justice being sick, absent from the Province, or otherwise unable or refusing to act, then such third arbitrator shall be appointed by any Judge of the High Court of Justice other than a local Judge. It is agreed that there may be an appeal by either party from any decision or award of such arbitrators



to the High Court of Justice for Ontario in accordance with the provisions of the *Arbitration Act* in that behalf.

20. Notwithstanding that there may be differences between the parties which may embrace the question of the supply or insufficiency of the power or the payment therefor or any other questions whatever that may arise under this agreement the Company shall continue to deliver the power and the Commission to pay therefor and both parties shall continue to carry out the contract notwithstanding such differences, and when the matters which may be in issue shall be finally determined by the reference as above provided, the parties shall deal with such matters according to the terms of the award that may be made on such reference. It being the distinct agreement between the parties that there shall not be during the period of the agreement any stoppage or cessation in the carrying on of the work, but that the same shall be continuous and any matters in difference shall not form a reason for interfering with the same but shall be accommodated in the manner herein provided.

21. The Company will not, directly or indirectly, deliver power in Ontario to any person or corporation that it is intended shall be supplied by the Commission under this agreement.

In case any difference arises as to such supply the same shall be settled by the said arbitrators.

This clause shall not, however, be held to cover or interfere with the supply of power agreed to be delivered by the said Company to any persons or corporations other than the Commission at the date on which the first block of power is ordered by the Commission from the Company under this agreement, but the said supply shall continue unaffected by this agreement.

22. The Company agrees that it will not exercise the right to cancel contained in the said agreement dated 11th April, 1900.

23. This agreement shall extend to and be binding upon and enure to the benefit of the successors and assigns of the parties hereto.

24. This agreement shall have no force or effect until approved by the Lieutenant-Governor in Council.

In witness whereof the said Commission has affixed its corporate seal and has signed, sealed and executed the present agreement; and the Company acting by and through its President and Secretary duly authorized for all purposes hereof has hereunto affixed its corporate seal under the hands of the President and Secretary.

A. BECK,  
JOHN S. HENDRIE.  
W. K. McNAUGHT.

(Seal.)

THE ONTARIO POWER COMPANY OF NIAGARA FALLS.

J. J. ALBRIGHT,  
*President.*

ROBERT C. BOARD,  
*Secretary.*

(Seal.)

#### SCHEDULE "B."

This Indenture made the \_\_\_\_\_ day of \_\_\_\_\_ 1908. Between The Hydro-Electric Power Commission of Ontario, acting herein on its own behalf and with the approval of the Lieutenant-Governor-in-Council (hereinafter called the "Commission"), party of the First Part, and The Municipal Corporations of (hereinafter called the "Corporations"), party of the Second Part.

Whereas pursuant to *An Act to provide for Transmission of Electric Power to Municipalities*, the Corporations applied to the Commission to transmit and supply such power from Niagara Falls, and the Commission entered into contracts with the Ontario Power Company of Niagara Falls, hereto attached, for such power at the prices set forth in the schedule hereto attached, and the Commission furnished the Corporations with estimates, as shown in said schedule, of the total cost of such power, ready for distribution within said Corporations, and the electors of the Corporations assented to By-laws authorizing the Corporations to enter into a contract with the Commission for such power, and the Commission have estimated the line loss and the cost to construct, operate, maintain, repair, renew and insure a line to transmit \_\_\_\_\_ horse power of such power to the Corporations, and have apportioned the part of such cost to be paid by each Corporation as shown in said schedule;

Now therefore this Indenture witnesseth that in consideration of the premises and of the agreements of the Corporations herein set forth, subject to the provisions of said Act and of the said contracts, the Commission agrees with the Corporations respectively:—

1.—(a) To construct a line to transmit the quantities of electric power, shown in column 2 of the said schedule, from Niagara Falls to the Corporations, shown in column 1, respectively:—

(b) On the                      day of                      19                      to supply said power in quantities set forth in column 2 of said schedule, or as a minimum                      per cent., less, to the said Corporations within the limits thereof, ready for distribution at approximately the number of volts set forth in column 4 of said schedule, and approximately 25 cycles per second frequency.

(c) At the expiration of three months' written notice, which may be given from time to time during the continuance of this agreement, to supply from time to time to the Corporations in blocks of not less than                      horse power each, additional power until the total amount so supplied shall amount to 30,000 horse power.

(d) At the expiration of nine months' like notice which may be given from time to time during the continuance of this agreement, to supply from time to time to said Corporations in blocks of not less than                      horse power each, additional power until the total amount so supplied shall amount to 100,000 horse power.

(e) To use at all times first-class, modern, standard, commercial apparatus and plant and to exercise all due skill and diligence so as to secure the most perfect operation of the said plant and apparatus of the said Corporations.

2. In consideration of the premises and of the agreements herein set forth each of said Corporations agrees with the said Commission:—

(a) To pay the Commission for the quantities of power shown in column 2 of said schedule, or                      per cent. less as a minimum, to be supplied at said date, and for such additional power supplied or held in reserve upon such notices, the price set forth in column 3 of said schedule in twelve monthly payments, in gold coin of the present standard of weight and fineness, and bills shall be rendered by the Commission on or before the first and paid by the Corporations on or before the fifteenth of each month. If any bill remains unpaid for                      days, the Commission may, in addition to all other remedies and without notice, discontinue the supply of such power until said bill is paid.

(b) To pay annually interest at four per cent. per annum upon a proportionate part of the moneys expended by the Commission on capital account for the construction of the said line.

(c) To pay an annual sum to form in thirty years a sinking fund for the retirement of the securities to be issued by the Province of Ontario, for the payment of a proportionate part of the cost of the construction of said line.

(d) To pay a proportionate part of the line loss and the cost to operate, maintain, repair, renew and insure the said line.

(e) To keep, observe and perform the covenants, provisos and conditions set forth in said contracts, intended by the Commission and the said Company to be kept, and observed and performed by the said Corporations.

(f) To pay for three-fourths of the power supplied and held in reserve at said date and upon said notices, whether the said power is taken or not, and when the greatest amount of power taken for twenty consecutive minutes in any month shall exceed three-fourths of the amount during such twenty consecutive minutes, so supplied and held in reserve, to pay for this greater amount during that entire month. When the power factor of the greatest amount of power taken for said twenty minutes falls below 90 per cent., the Corporation shall pay for 90 per cent. of said power divided by the power factor.

(g) To take no more power than the amount to be supplied and held in reserve at said date and upon said notices.

(h) To use at all times first-class, modern, standard, commercial apparatus and plant to be approved by the Commission.

(i) To exercise all due skill and diligence so as to secure the most perfect operation of the plant and apparatus of the said Commission and said Company.

(j) To take such power exclusively from the Commission during the continuance of this agreement.

3. Unless determined as provided in said contracts this agreement shall remain in force for forty years from the said                      day                      , 19                      .

4. Said power shall be three phase, alternating, commercially continuous



twenty-four hour power every day of the year except as provided in paragraph 6 hereof, and shall be measured by curve-drawing meters, subject to test as to accuracy by either party hereto.

5. The engineers of the Commission, or one or more of them, or any other person or persons appointed for this purpose by the Commission, shall have the right from time to time during the continuance of this agreement to inspect the apparatus, plant and property of the said Corporations and take records at all reasonable times on giving to the Corporations six hours' notice of the intention to make such inspection. The said Corporations shall have a like right, on giving a like notice to inspect the apparatus, plant and property of the Commission.

6. In case the Commission or the Company shall at any time or times be prevented from delivering said power, or any part thereof, or in case the Corporation shall at any time be prevented from taking said power, or any part thereof, by strike, lock-out, riot, fire, invasion, explosion, act of God or the King's enemies, or any other cause reasonably beyond their control, then the Commission shall not be bound to deliver such power during such time and the Corporations shall not be bound to pay the price of said power at Niagara Falls during such time, but the Corporations shall continue to make all other payments, but as soon as the cause of such interruption is removed the Commission shall without any delay supply said power as aforesaid and the Corporations shall take the same and each of the parties hereto shall be prompt and diligent in removing and overcoming such cause or causes of interruption.

7. If and so often as any interruption shall occur in the service of the Company due to any cause or causes, other than those provided for by the next preceding paragraph hereof, the Commission shall recover and pay to the said Corporations as liquidated and ascertained damages, and not by way of penalty, as follows:—For any interruption less than one hour double the amount payable for power which should have been delivered during the time of such interruption, and for any interruption of one hour or more, the amount payable for the power which should have been delivered during the time of such interruption and twelve times the last mentioned amount in addition thereto and all moneys payable under this paragraph when the amount thereof is settled between the Commission and the Company may be deducted from any moneys payable by the said Corporations to the Commission, but such right of deduction shall not in any case delay the said monthly payments.

8. The maintenance by the Commission of approximately the agreed voltage at approximately the agreed frequency at \_\_\_\_\_ shall constitute the supply of all power involved herein and the fulfilment of all operating obligations hereunder; and that when voltage and frequency are so maintained, the amount of the power, its fluctuations, load factor, power factor, distribution as to phases, and all other electric characteristics and qualities are under the sole control of the Corporations, their agents, customers, apparatus, appliances and circuits.

9. In case any of said Corporations, or any person, firm or Corporation which shall contract with any of said Corporations for supply of power furnished to the Commission by the Company shall suffer damages by the act or neglect of the said Company, and such municipal Corporation, person, firm or Corporation would, if the Company had made this contract directly with them, have had a right to recover such damages or commence any proceedings or any other remedy the Commission shall be entitled to commence any such proceeding or bring such action for or on behalf of such municipal Corporation, person, firm or Corporation, and notwithstanding any acts, decision or rule of law to the contrary, the Commission shall be entitled to all the rights and remedies of such municipal Corporation including the right to recover such damages, but no action shall be brought by the Commission until such municipal Corporation, person, firm or Corporation shall have agreed with the Commission to pay any costs that may be adjudged to be paid if such proceeding or action is unsuccessful. The rights and remedies of any such municipal Corporation, person, firm or Corporation shall not be hereby prejudiced.

10. The Commission shall annually adjust and apportion the amounts payable by municipal Corporations for such power and such interest, sinking fund, line loss, and cost of operating, maintaining, repairing, renewing and insuring the line and works.

11. This agreement shall extend to, be binding upon and enure to the benefit of the successors and assigns of the parties hereto.

12. Notwithstanding anything hereinbefore contained this agreement shall not come into operation as against the Commission or be binding upon the Commission until, in addition to any other Orders in Council, pursuant to said Act, an Order in Council has been passed and approved by the Lieutenant-Governor in Council expressly declaring that this agreement shall from the date of such Order in Council be binding upon the Commission.

In witness whereof.

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Column 1	2	3	4	5	6	7
Name of Municipal Corporation.	Quantity of power ap- plied for in H.P.	Maximum price of power at Niagara Falls.	No. of volts.	Estimate maximum cost of power ready for distribution in muni- cipality.	Estimate proportionate part of cost to con- struct transmission line for 30,000 H.P.	Estimate proportionate part of line loss and of part cost to operate, maintain, repair, re- new and insure trans- mission line for 30,000 H.P.
Toronto .....	10,000	<p>\$9.40 for power at 12,000 volts until 25,000 H.P. or more, in all, are taken, then \$9.00. \$10.40 for power at 60,000 volts until 25,000 H.P. or more, in all, are taken, then \$10.00. if power taken at higher voltage, price to be fixed by arbitration.</p>	.....	\$18.10	.....	.....

## REPORT OF P. W. SOTHMAN, CHIEF ENGINEER.

### NIAGARA DISTRICT TRANSMISSION.

#### SURVEYS, 1907.

The surveys for the route of the transmission lines to the municipalities to be fed from Niagara Falls were started in 1907.

#### AUTHORITY.

These surveys were undertaken in accordance with instructions contained in the minutes of the Hydro-Electric Power Commission meeting of June 13th, 1907, the extract pertaining to this matter reading as follows: "The Chief Engineer submitted a statement showing the number of additional men required to carry out the work of the Commission in connection with surveys, plans of inter-switching, transformer stations, etc., and it was decided to approve of same; and authorizing, if found necessary, the placing of four survey parties in the field, each party to consist of up to six men, all to provide their own outfits; and to engage such additional engineers as may be deemed necessary to carry out the plans of the Commission."

Acting upon these instructions, Assistant Engineers Richards and Acres were despatched immediately to make a reconnaissance survey of the district, taking in all the municipalities from which applications for power had been received. It was later found necessary to place Assistant Engineer Stocking in the field and all the reconnaissance work was performed by the three engineers above mentioned.

#### RECONNAISSANCE.

Each section of country through which a projected line was to run was examined in detail by at least two members of the reconnaissance staff working independently. Daily reports were submitted by them to the Toronto office giving individual opinions as to the proper location of the projected line. When the work above described was completed on any section, your Chief Engineer made a tour of inspection and the final decision as to the location of the line rested with him, after weighing the recommendations of his assistants. In this way all phases of the problem were considered, and it is reasonably certain that the location as laid down in the plans are the best obtainable under existing circumstances.

#### GENERAL GOVERNING CONDITIONS.

In making these surveys the primary object was naturally to obtain the shortest and most direct route possible between points of local distribution, but this idea was of course modified by conditions, local and otherwise, which it was necessary to offset against the other.

Every effort was made to keep the located line parallel to the property lines and as close to the fences as possible. It was thought that this would have a decided tendency to reduce the right-of-way cost, as most land-owners would much prefer a line located in this way to one which would cut their fields diagonally, and the saving due to this should more than offset the cost of any small amount of extra line that might be necessary. Obstacles in the form of houses, barns and other buildings had also to be considered, but any changes in location due to this were comparatively unimportant.



A very important point to be considered in the line location is the liability of damage by lightning. On many existing transmission lines it has been observed that lightning trouble seems to be confined to more or less restricted localities so that while the greater part of the line is practically unmolested, lightning damage, usually in the form of broken insulators, occurs frequently on one portion of the line. Telephone and telegraph lines in several instances disclosed evidence of this trouble and care was taken to avoid these localities wherever possible.

Another contingency which it was considered advisable to allow for was the possible falling off in insulator efficiency due to smoke deposits accumulating on the lower surfaces of the insulators. With this object in view an effort was made to avoid paralleling railway lines where a large number of trains pass daily, and also to avoid railway stations and yards where there is any considerable amount of shunting. Although the liability of injury to the lines from this cause would be somewhat remote in the majority of cases, it seemed reasonable to consider the point in the general scheme. Information was also obtained with reference to the condition of various roads, it being desirable to ascertain if any were liable to be drifted in the winter, or flooded in the spring, to such an extent as to make them impassable.

It was necessary in some places to carry the line through heavy timber, this being done usually without any deflection or detour. The extra expense involved will be due not only to the cost of clearing the actual right-of-way, but because a strip varying in width from 25 to 70 feet must be cleared on either side of the right-of-way to insure the line against damage by wind-falls. These drawbacks are in a measure offset by the fact that heavy timber near the line has a tendency to lessen the lightning hazard and also affords a certain amount of wind protection.

#### NEW METHODS OF CONSTRUCTION.

These surveys differed from the usual 60,000 volt practice in this part of the country in that the possibility of carrying the line along the country roads has been considered. The mesh protection with which the line will be equipped and the substantial design of the towers will insure the public so completely against the possibility of accident, that it appears quite possible to carry out this idea wherever topographical conditions permit.

All the roads in the power district were examined with this object in view, the result being that the greater portion of the lines, as at present located, lie along the public roads. An effort was made to carry the lines along the least travelled roads and also along unopened road allowances wherever possible. The chief obstacles encountered were farmhouses and other buildings close to the line, and the lines of the Bell Telephone Company, pole-lines carrying from ten to thirty wires being frequently encountered throughout the district. Lines of shade trees along the road-sides complicated the problem to a certain extent, but any deviation from the direct line between points of local distribution is due principally to the causes first mentioned.

#### ADVANTAGES OF NEW METHOD OF CONSTRUCTION.

Among the principal advantages resulting from the proposed method of construction and the present location of the lines may be mentioned the following:

(1) Cheap right-of-way. The reduction in the cost of right-of-way owing to the use of the roads is easily apparent, but in addition to this, when it is necessary

to carry the line through private property the mesh protection will obviate the necessity for fencing the right-of-way. For this reason the land-owners will be able in most cases to continue using the land around the towers, the obstruction as regards cultivation being no greater than that caused by the wind-mill towers so common in the farmers' fields at the present time. This consideration should have a markedly favorable influence upon the cost of right-of-way.

(2) Reduction in transportation cost: a large item of expenditure during construction will be the cost of teaming construction material. The advantage of having the delivery points for this material along, or in the immediate vicinity of travelled roads is obvious.

(3) Better facilities for inspection and patrol. With the lines located in the manner above described a member of the engineering staff will be able to make periodic trips of inspection over the whole line in a comparatively short time. If the lines were carried across country, engineering inspection would consume a great deal of time and it would be necessary to entrust the bulk of this work to more or less inexperienced patrolmen.

For convenience, the district was divided into sections as follows:—

Section A.—From Niagara Falls to Hamilton and the Burlington Canal.

Section B.—From the Burlington Canal to Toronto.

Section C.—From Hamilton to Brantford.

Section D.—From Brantford to Woodstock.

Section E.—From Woodstock to London *via* Ingersoll.

Section F.—From Hamilton to Guelph.

Section G.—From Stratford to Guelph *via* Berlin, Waterloo, Preston and Hespeler.

Section H.—From London to Stratford *via* St. Marys.

Section I.—From London to St. Thomas.

Section L.—From Preston to Brantford *via* Galt and Paris.

There were also two short sections not classified as above, namely, a branch line from Humber Bay to Toronto Junction and a line from the location of the interswitching station near Stoney Creek around the bay to Burlington Village, intended as an alternative to the line across Burlington Beach.

#### SECTION A.—NIAGARA FALLS TO BURLINGTON CANAL.

Work on Section A. was begun on June 17th, 1907, at Niagara Falls and the preliminary line to the Burlington Canal, a distance of  $44\frac{1}{4}$  miles was completed by August 25th, 1907. Locations and levels were begun at Niagara on August 26th and the survey was finally completed on October 1st, 1907.

In connection with this survey, it may be said that its cost averages more per mile than that of any other section. This is due partly to topographical conditions but mainly to the care and accuracy with which the survey was made. Taking into consideration the possibility of additional lines being at some future time built parallel to the original trunk line from Niagara Falls to Hamilton, the topography was taken with great care, the line was substantially located and the bearings of all property lines were established with a transit. The result is that the line as it stands will serve not only for the location of the original transmission line, but will furnish reference points for the location of any line to be built in the future.

The line through this section is believed by your engineers to be the shortest and most direct possible under existing conditions, but as in the case of the survey, the average construction cost per mile will be greater than elsewhere in the district.

This is due primarily of course to the greater line capacity required, but the cost will be still further augmented by reason of the comparatively large amount of special construction necessary. Between Niagara Falls and Burlington Beach it will be necessary to cross eight steam and electric railways, telephone and telegraph lines, five power transmission lines, and the Welland Canal. These crossings will involve the expenditure of a considerable sum for line insulators, crossing towers and labour, over and above that required for standard construction.

The located line after running out Dixon Street for three-quarter miles to the city limits of Niagara Falls, cuts straight across country to the Welland Canal at Allanburg, a distance of  $5\frac{3}{4}$  miles. With the exception of one small deflection this portion of the line is an unbroken tangent across practically level country. Special construction will be necessary to cross the lines of the Wabash and Grand Trunk Railways near Allanburg and also at the Welland Canal. The canal crossing, as at present located, is a very favorable one, as the plans will show. The advantage of this crossing location is that the height of the canal banks on either side will reduce the height of the crossing-towers, which must be constructed so as to give 150 feet of clearance between the lower wires of the mesh protection and the surface of the canal.

After crossing the canal the line deflects to the right and runs diagonally across country for one mile till it reaches what is known as the Holland Road, and parallels this road just inside the southern line fence for  $1\frac{3}{4}$  miles. It then takes another small deflection to the right and intersects with the produced line of an unopened road allowance across the St. John valley, this line being followed for two miles across the valley. It may be said in passing that some difficulty was anticipated in connection with the location of the line at this point, but the location as laid down is of such a nature as to insure a good line gradient and a reasonable length of span, and is on the whole much more favorable than would reasonably have been hoped for. After crossing the St. John valley the line parallels the road allowance between concessions 3 and 4 of the Township of Pelham to the township line between Pelham and Gainsboro, a distance of  $4\frac{1}{2}$  miles. At this point it crosses the transmission line of the Toronto-Niagara Power Co., and parallels the Toronto-Niagara right-of-way through Gainsboro, Clinton and a short distance into Grimsby Township, in all a distance of ten miles. In Grimsby Township the line meets the road allowance between concessions 5 and 6, which it follows to the township line between Grimsby and Saltfleet, a distance of five miles. This road allowance is unopened for the greater part of the distance and the line is located upon the right-of-way. At this point the line crosses the main line of the Toronto, Hamilton and Buffalo Railway and one of the Cataract Power Company's transmission lines, which is located on the railroad right-of-way. The line is here slightly deflected to the left to meet the road allowance between concessions 5 and 6 of the Township of Saltfleet, which it parallels for six miles to the side road between lots 22 and 23 in the 5th concession of Saltfleet. At this point thirty-six and three-quarter miles from the Ontario Power Company's transformer station, it is proposed to erect the main interswitching station for the distribution of power to the eastern and western lines. Leaving the interswitching station, the line follows the side-road above mentioned to where it is crossed by the transmission line of the Toronto-Niagara Power Co., a distance of  $2\frac{1}{2}$  miles. In this distance special construction will be necessary to carry the line over the escarpment which at this point drops 270 feet in 1,000. It will also be necessary to cross one of the Cataract Power Company's transmission lines, the main line of the Toronto, Hamilton and Buffalo Railway and the Hamil-



ton, Grimsby and Beamsville Railway. Upon reaching the point above specified the line swings to the left and parallels the Toronto-Niagara right-of-way for two miles, crossing in this distance the main line of the Grand Trunk branch line across Burlington Beach, following the right-of-way to the Beach Road, a distance of  $1\frac{1}{2}$  miles. For the rest of the distance,  $2\frac{1}{4}$  miles, the preliminary line is run along the Beach Road to the canal, but no definite location was made on this section. In this connection it may be said that considerable structural difficulty is anticipated in carrying the line across Burlington Beach owing principally to the restricted space, there being at present one steam road, one electric road, a telephone line, a telegraph line, and two power transmission lines located thereon. At the narrower portions of the Beach the congestion is serious and the only apparent alternative, in case the Beach route is adopted, is either to support the line on towers much higher than those of standard type or to carry the line around the shore of the bay on standard towers set on concrete footings. As yet no final decision has been arrived at, it being thought advisable to first consult the local authorities, and final location was laid over pending their ultimate decision.

The crossing of the Beach Canal will also involve considerably more structural difficulty than in the case of the Welland Canal. Here, as in the case of the Welland Canal, 150 feet clearance to water-level is required in the interests of navigation, and the topographical conditions are such as to require a much more expensive steel structure than will be necessary in the case of the Welland Canal.

#### SECTION B.—TORONTO TO BURLINGTON CANAL.

Work on Section B was begun on July 2nd, 1907, at Toronto, and the preliminary line to the Burlington Canal, a distance of  $38\frac{1}{2}$  miles, was completed by August 11th, 1907. Location and levels were started at Toronto on August 12th, 1907, and the survey was finally completed on October 2nd, 1907. The survey between Humber Bay and Toronto Junction was commenced on October 7th, 1907, and completed on October 13th, 1907.

The survey of this section was carried out in a manner similar to that of Section A., but with a slightly less degree of accuracy as the lesser importance of the line warranted. The line, however, has been established in a substantial manner, and as in the case of the Niagara-Burlington section, will serve for the location of subsequent lines should their construction become necessary.

Taking into consideration topographical conditions, natural and otherwise, the line as located is believed to be the most direct possible, and the one which will require the least amount of special construction. As was to be expected, the chief difficulties encountered were at the extremities of the line, in connection with the entrance to Toronto, and the location of that portion of the line across Burlington Beach which is included in Section B. As regards Toronto, it will involve considerable structural difficulty to carry the line to a centrally located sub-station, and the final location of the entrance line should be largely a matter of adjustment between the city authorities and the members of the Power Commission. The reason for not establishing a final location across the Beach has been explained in connection with the survey of Section A.

Upon leaving the city limits, the line crosses Grenadier Pond, Ellis Avenue, Windermere Avenue, Jane Street and the Humber River on the same tangent. From the west bank of the Humber the line takes a deflection to the right and runs across to intersect with College Street, which it follows across Mimico Creek to Church Street, concession B, a distance of  $2\frac{1}{4}$  miles from the city limits. Con-

tinuing on the same tangent the line here crosses a stretch of farm land, keeping close to the property lines, and meets the road between concessions 3 and 4 of Etobicoke, which it follows for one mile till it crosses the transmission line of the Toronto-Niagara Power Co. The line then leaves the road, deflects a short distance to the left then takes a deflection to the right, crosses Etobicoke Creek and runs across country for  $3\frac{1}{2}$  miles till it meets the gravel road between Port Credit and Cooksville,  $9\frac{1}{4}$  miles from Toronto city limits. Crossing this road it follows what is known as the Indian Road across the Credit River until it meets the gravel road between Erindale and Port Credit, a distance of  $3\frac{1}{2}$  miles. From here the line again runs across country for five miles till it meets the seventh side-road of Trafalgar Township in the County of Halton, two miles north of Oakville. The line here deflects to the left for half a mile and intersects with the road allowance between concessions 1 and 2 of Trafalgar, following the road across Oakville and Bronte Creeks as far as the gravel road running north out of Burlington, a distance of 11 miles. The line then follows this road south for a mile, when it swings off to the right past the western extremity of Burlington Village, crosses the main line of the Grand Trunk and parallels the right-of-way of the Grand Trunk line across the Beach as far as the lake shore, after which it follows the Beach road to the canal.

Between the city limits of Toronto and Burlington Beach it will be necessary to cross two steam railroads, one power transmission line, and one telephone line. Water crossings include Grenadier Pond, the Humber River, Mimico Creek, Etobicoke Creek and Bronte Creek. Long spans, involving special tower-construction, will be necessary to cross Grenadier Pond, the Humber River and Oakville and Bronte Creeks. All other line construction, with the exception of corner and transposition towers, will be of standard and uniform type, within the limits above specified. It will be noted that the number of artificial obstructions on this section is small as compared with Section A, but on the other hand the natural conditions and the highway system combine to make location less favorable and construction more difficult than will be the case in Section A. On portions of the cross-country sections it was found impossible to locate the line favorably with regard to the lot lines. On account of the thick stratum of red clay which overlays bedrock, the streams in this section lie either in wide, deep, heavily wooded valleys or in deep ravines with precipitous clay banks on either side. As before mentioned, special construction will be necessary at many of these points. Transportation costs will also be affected owing to the fact that some of the road allowances are unopened across these streams, a detour of two or three miles being necessary in some cases to cross them.

#### SECTION C.—BRANTFORD TO HAMILTON.

Work on Section C was commenced in Brantford and the line was carried through and tied into the Niagara-Hamilton line at the proposed location of the main interswitching station, the distance being  $27\frac{1}{2}$  miles. The adoption of this line will involve a considerable amount of special construction within the corporation limits of Brantford, the line being very crooked, with short tangents and large deflections. The same conditions exist more or less as far as Cainsville. The general direction of the line changes after leaving Cainsville, swinging off to the left and travelling across country for  $6\frac{1}{2}$  miles to the county line between Brant and Wentworth. This portion of the line, although direct, has one serious disadvantage in that it crosses lots diagonally, although topographical conditions are otherwise

fairly good. After reaching the Brant County boundary the line meets the road allowance between concessions 4 and 5 of the Township of Ancaster. It follows this road as far as the township line between Ancaster and Glanford, a distance of  $7\frac{1}{4}$  miles, from which point it again runs across country, cutting lots diagonally, as far as Mount Albion, a distance of  $5\frac{1}{2}$  miles. The line here continues across country till it meets the road allowance between concessions 5 and 6 of Saltfleet, following this road for three miles, where it ties in with the Niagara-Hamilton line at the site of the proposed interswitching station.

In view of the generally unfavorable location of the line above described, it was later thought advisable to run another line through this section to the north of the one above described. This new line tied in with the line through Section D about three miles north-west of Brantford on the road allowance between Concessions II. and III. of Brantford Township. The line follows this road across the Grand River as far as the county line between Brant and Wentworth, a distance of  $3\frac{1}{2}$  miles, the last two miles of the road allowance being unopened. The line follows the County boundary for two miles till it reaches the produced road allowance between Concessions 3 and 4 of Ancaster. It then follows the unopened section of this road for two miles and continues along the travelled section of this road for  $7\frac{1}{4}$  miles as far as the township line between Ancaster and Barton. It then takes a small deflection and travels across country for  $2\frac{1}{2}$  miles till it meets the road allowance between concessions 6 and 7 of Barton and follows this road  $3\frac{1}{4}$  miles to Mount Albion. It then takes a deflection left across country for two miles till it meets the road allowance between concessions 5 and 6 of Saltfleet, following this road for  $1\frac{1}{2}$  miles till it ties in with the Niagara-Hamilton line at the site of the interswitching station, the total length of this line being  $28\frac{3}{4}$  miles. On this line it will be necessary to cross five steam and electric railways, one high voltage transmission line and two telephone lines. Special construction may also be required at the crossing of the Grand River. The west bank of the river is high, but the opposite bank is quite low and although enquiry and investigation appears to indicate that it has never been flooded it will probably be deemed advisable to put in special tower foundations. For two miles along the road allowance between concessions 3 and 4 of Ancaster, the line is paralleled by an eight-wire G.N.W. telegraph line, which will give trouble, owing to the fact that it crosses and re-crosses the road several times in this distance.

As above described the greater part of this line lies upon opened roads and with the exception of the two-mile section above mentioned, the conditions are favorable. There is considerable timber on the cross-country sections and the lots are cut diagonally, but none of these sections are of sufficient length to seriously affect the line as a whole. The location through Ancaster Township is not so favorable by this line as by the south line originally surveyed, but all things considered the north line is much to be preferred, as it is more direct, less liable to be affected by floods and will be much easier to patrol and repair, as it lies mainly along the roads.

The interswitching station connecting this line with the Preston line is situated about a mile and a half from the load centre of the City of Brantford and forms a convenient point for connecting a spur line to feed this city.

#### SECTION D.—WOODSTOCK TO BRANTFORD.

After leaving the proposed sub-station site at Woodstock, this line runs across lots for 0.3 of a mile to meet the road allowance between concessions 1 and 2 of



East Oxford, following this road for  $6\frac{1}{4}$  miles to the county line between Oxford and Brant. The line continues along this road through Burford Township for  $9\frac{1}{2}$  miles as far as the township line between Burford and Brantford, and then swings southward across country for  $3\frac{1}{4}$  miles till it reaches the road allowance between concessions 2 and 3 of Brantford. At this point it ties in with the north alternative line surveyed between Brantford and Hamilton. From here the line continues across country for  $4\frac{3}{4}$  miles with some small deflections until it reaches the corporation limits of West Brantford, whence it runs along the West Brantford dykes and ties in with the south line surveyed from Brantford to Hamilton. The total length of line from Woodstock to Brantford is  $23\frac{1}{4}$  miles.

Concerning the line above described, it may be said that in no other part of the district has a location been obtained so uniform and altogether favorable, there being no special construction necessary of any kind, other than the erection of two or three corner towers. There are no railway or large stream crossings and only five telephone line crossings. The chief drawback in connection with this line is the cross-country section, but apart from the fact that the line crosses the lots diagonally, the topographical conditions are very favorable.

#### SECTION E.—LONDON TO WOODSTOCK.

As in the case of Toronto, a line entrance has been surveyed into the City of London, but its final adoption is still an open question, pending the joint decision of the Commission and the municipal authorities.

Leaving the site of the London interswitching station the line runs across country for  $3\frac{1}{2}$  miles, paralleling the river as to general direction till it meets the given road following the north bank of the Thames through Dorchester. The line follows this road for one mile, then crosses the main line of the Grand Trunk and parallels the right-of-way for  $3\frac{1}{4}$  miles past Dorchester till it meets the road allowance between concessions 4 and 5, Dorchester Township, which it follows for  $3\frac{3}{4}$  miles to the county line between Middlesex and Oxford. The line continues along this road for  $3\frac{3}{4}$  miles through the Township of North Oxford to a point half a mile west of Ingersoll, where it crosses the Grand Trunk main line and the Thames river and covers the remaining distance to the sub-station site in Ingersoll, the total length of line from London being 17 miles.

Leaving the Ingersoll sub-station site the line swings to the right across the river and follows a direction approximately midway between the river and the Canadian Pacific Railway for  $4\frac{1}{4}$  miles to within a short distance of Beachville. The line then takes a deflection to the left to avoid the village, and crosses the river and runs between the river and the Grand Trunk main line for four miles where it again crosses the Thames at the corporation limits of Woodstock and runs into the proposed sub-station site, the total distance from Ingersoll being  $9\frac{1}{2}$  miles.

The first stretch of line from the London interswitching station to the Dorchester road, runs across country on one tangent. Its diagonal direction with reference to the lots is the main topographical feature of this portion of the line. A number of groves of large trees and some cedar swamp is encountered, but the general layout is good and land damages should be reasonable, as a good portion of the land crossed is not cultivated.

No serious obstacles will be encountered on the road allowance between Dorchester and Ingersoll, there being no telephone or telegraph lines upon it, and the buildings as a rule are well back from the road.

Between Ingersoll and Woodstock it was not found practicable to make use of the roads, but the line lies almost wholly on uncultivated land, so that damages should not be excessive. The chief item will be in connection with clearing as the route is thinly but uniformly overgrown with hardwood timber. It will be necessary to further examine this section of the line during the spring when the Thames is in flood, to ascertain whether any portions of the line are below the limits of flood-water. Portions of the line evidencing this condition will probably require re-location.

Between London and Woodstock it will be necessary to cross three steam and one electric railway, and six telephone lines. Five crossings of the south branch of the Thames will also be necessary but no special construction will be required. These figures do not include the portions of the line within the city limits of London and Woodstock, the amount of special construction depending in this case on the final location of the respective sub-stations.

#### SECTION F.—HAMILTON TO GUELPH.

Work on Section F was commenced at the site of the main interswitching station near Stoney Creek and the line as located follows the opened section of the road allowance between concessions 5 and 6 of Saltfleet for  $1\frac{1}{2}$  miles. It then follows the produced line of this road allowance across a valley formed by the Niagara escarpment until it meets the road allowance between concessions 5 and 6 of Barton Township, following this road for  $4\frac{3}{4}$  miles, after which it takes a considerable deflection to the right and runs direct across country for  $6\frac{1}{2}$  miles till it meets the township line between East and West Flamboro' in Wentworth County, following this road for  $8\frac{1}{2}$  miles. It then swings off to the right across country for  $1\frac{3}{4}$  miles till it meets the road allowance between concessions 8 and 9 of Puslinch, in the County of Wellington. It follows this road for 11 miles as far as the Canadian Pacific Railway crossing, at which point it swings in to the left to the city limits of Guelph, the total length of line from the main interswitching station to the site of the sub-station in Guelph being  $37\frac{1}{2}$  miles. This line crosses three steam and two electric railways, two telegraph lines and five telephone lines. One unfavorable feature in connection with this line is that it is necessary to parallel a four-wire telephone line for fifteen miles and a twenty-wire line for  $2\frac{3}{4}$  miles.

Special construction will also be necessary to cross the Dundas marsh, where towers in many cases will have to be placed on concrete or pile foundations. Over the greater portion of this route the country is hilly and irregular in consequence of which the line gradient will be effected and construction cost will be greater than over more regular sections. Apart from the Dundas marsh any low ground encountered will give no trouble.

#### SECTION G.—GUELPH TO STRATFORD.

On leaving the city limits of Guelph the line follows the Speed River for two and one-half miles, crossing it five times in this distance, till it reaches the Waterloo Road, which it follows for three and one-half miles to within half a mile of the county line between Wellington and Waterloo. Here it takes a deflection to the left and follows the produced line of an unnamed given road to the immediate vicinity of the town of Hespeler, a distance of one and three-quarter miles, the total length of line between Guelph and Hespeler being seven and three-quarter miles.

The line skirts the north-western section of the town for  $1\frac{1}{2}$  miles when it swings to the left, crossing the Speed River and the Galt, Preston and Hespeler Railway near the western corporation limits. At this point it takes a deflection to the right and parallels the general direction of the Galt, Preston and Hespeler right-of-way to the vicinity of the corporation limits of Preston, a distance of  $1\frac{1}{4}$  miles. The line here swings to the right, crossing the river and the electric railway and running a short distance to the proposed sub-station location within the town. The total length of line from Hespeler to Preston is  $2\frac{1}{2}$  miles.

Leaving the sub-station location again the line runs north-west across country for  $1\frac{1}{4}$  miles, till it meets the line of the Preston and Berlin Electric Railway, which it parallels for one half mile. It then runs across country for  $2\frac{1}{4}$  miles till it reaches the vicinity of Centreville, where it runs through the village and parallels the right-of-way for three miles, to within a short distance of the City limits of Berlin, from which point two alternative lines have been run in to the proposed sub-station location, the total length of line from Preston to Berlin being  $7\frac{3}{4}$  miles.

Leaving Berlin the line skirts the western limits of the city and approaches to within distribution distance of Waterloo,  $1\frac{1}{2}$  miles from Berlin sub-station. Here the line takes a deflection west across country for two miles till it meets the Erb Road which it follows for  $1\frac{3}{4}$  miles to the Township line between Wilmot and Waterloo in the county of Waterloo and follows this road for five miles, with a detour round the village of St. Agatha, as far as the second side-road in Wilmot. A deflection of about forty-five degrees is made here and the line runs across country for  $2\frac{1}{2}$  miles till it meets the Snider Road, half a mile west of Baden. It here angles to the west across country for  $2\frac{1}{4}$  miles as far as the County line between Waterloo and Perth, and meets the road allowance between concessions II. and III. of Easthope North in Perth County, which it follows for  $10\frac{1}{4}$  miles, after which it swings off across country for two miles to the corporation limits of Stratford, where it approaches the site of the proposed sub-station. The total length of line from Berlin to Stratford is  $26\frac{1}{2}$  miles. In this district also a direct alternative line was surveyed between Guelph and Berlin. This line follows the same route as the one above described as far as the Waterloo Road  $2\frac{1}{2}$  miles from Guelph. The direct line here branches off and follows the road allowance between lots three and four of Division B in the Township of Guelph for  $3\frac{1}{4}$  miles as far as the County line between Wellington and Waterloo. The produced line of this road is then followed for one quarter mile across country when it swings to the right and follows a short road allowance for three-quarter miles. Keeping the same general direction the line continues for  $4\frac{1}{2}$  miles across country when it swings to the left and follows for  $2\frac{3}{4}$  miles along another section of apparently given road and this road produced till it crosses the line of the Preston and Berlin Electric Railway, at which point it ties in with the original line, running thence into Berlin. The total distance from Guelph to Berlin by this route is  $16\frac{1}{2}$  miles.

Between Guelph and Hespeler the line parallels a two-wire telephone line and crosses it twice. It also parallels a two-wire telegraph line and crosses it several times, so that special construction or arrangement will be necessary. The portion of the route paralleling the general direction of the Galt, Preston and Hespeler Railway runs for the most part through meadow land and scrub timber, none of it being very valuable, and though somewhat low, no danger from flood is anticipated. In this district the line crosses the electric railway twice and is always accessible from it.



Between Preston and Berlin the line parallels the Preston & Berlin Electric Railway and a main line of the Bell Telephone Co., for three miles, crossing the railway twice. The line also crosses the Grand River, but no special construction will be necessary.

A short distance west of Waterloo the line crosses a two-wire telephone line and parallels it for four miles. Near St. Agatha the line crosses a second two-wire telephone line. In the detour at St. Agatha the line follows the property line dividing the old and new portions of the Catholic Cemetery, but as it will not be necessary to place towers on the property no difficulty is anticipated with regard to right-of-way.

The tangent across country north of Baden passes for a short distance through rather heavy hardwood timber, the remainder being through open farm land. North of the Snider Road, a swamp, one-quarter mile long is crossed. No special construction will be required to cross the Nith River.

The whole section between Waterloo and Stratford is over country which is rather more irregular than could have been desired, but it is believed that the line above described is the best obtainable.

#### SECTION H.—STRATFORD TO LONDON.

On leaving the sub-station location at Stratford the line runs westerly across country for four miles to the second side-road of Downie, in the County of Perth, following this road for  $5\frac{1}{2}$  miles to the crossing of the Sarnia line of the Grand Trunk. Crossing the railway the line angles across country for  $1\frac{1}{4}$  miles into the corporation limits of St. Mary's, the total distance from Stratford being  $11\frac{1}{4}$  miles. Leaving St. Mary's, the line follows the third side-road of Blanchard for  $1\frac{1}{4}$  miles to the county line between Perth and Middlesex, from which point it angles westerly across country for three miles to the sixth side-road of Nissouri West, a short distance west of the village of Wellburn, following this road for four miles to within half a mile of the village of Devizes, where it swings to the left across country for  $2\frac{1}{2}$  miles as far as the first side-road of London Township. The line continues along this road for ten miles till it crosses Dundas Street (the Governor's Road). From this point the line defects westerly for  $1\frac{1}{4}$  miles down to the Gore Road, which it follows for one mile, thence skirting the eastern limit of the city of London and tying in with the London-Woodstock line at the site of the interswitching station. The total distance from St. Mary's to London by this route is 24 miles.

With the exception of two crossings of the Grand Trunk Sarnia line no special features exist between Stratford and St. Mary's. Low places are occasionally encountered, but no great trouble is anticipated from this cause.

Between St. Mary's and the London interswitching station are three crossings of the Grand Trunk and one of the Canadian Pacific. The line also crosses the Thames River at two points, one crossing requiring special construction. The line parallels a one-wire telegraph line for  $1\frac{3}{4}$  miles and crosses four telephone lines and two telegraph lines exclusive of the lines located on the railways.

As before mentioned a line was also surveyed along the Grand Trunk between London and St. Mary's. This line was much more direct than the one above described, but was abandoned owing to the possibility of the line insulation being affected by smoke.

## SECTION I.—LONDON TO ST. THOMAS.

This line was run from the proposed site of the London interswitching station.

Leaving this point the line crosses the south branch of the Thames River, running south to the road allowance between lots 18 and 19 of concession 1 of Westminster, County of Middlesex, a distance of one-half mile. It follows this road for three miles, as far as Wilton village, making a slight detour at the village of Pond Mills, after which it follows the produced line of this road along the lot lines as far as the county line between Middlesex and Elgin, a distance of  $5\frac{1}{4}$  miles, running west along the county line for one-half mile and turning south again at the first road allowance. It then follows this road for four miles as far as the crossing of Kettle Creek, at which point the line angles to the right and follows the creek valley for  $1\frac{3}{4}$  miles, which carries it into the sub-station location in St. Thomas. The total distance from London to St. Thomas by this route is  $14\frac{1}{4}$  miles.

This line as a whole is favorable, the cross country sections being for the most part parallel and close to the lot lines, except where the line follows Kettle Creek into St. Thomas. Here, however, the land is uncultivated. One crossing of the Thames River is necessary just leaving London. Special construction will be necessary here on account of the long span and the difference in elevation of the banks. There are also two railway and two telephone line crossings. Near the village of Pond Mills one portion of the line will be flooded in the spring but not more than one tower will require special treatment on this account.

A portion of the cross county line is thinly wooded with heavy timber and a number of deep ravines are encountered, none of which, however, will make special construction necessary as they can be crossed by standard spans.

## SECTION L.—PRESTON TO BRANTFORD.

The survey of this line was commenced at the sub-station location in Preston. Leaving the sub-station the line takes a south-westerly direction for  $1\frac{1}{2}$  miles, crossing in this distance the Grand River and the Grand Trunk Railway, and continuing to the township line between Waterloo and North Dumfries. It deflects to the left at this point and follows a short section of given road for one mile, thence running half a mile across country with a slight deflection right, meets the end of the side-road between lots 18 and 19 of concession 11 of North Dumfries, crossing the Canadian Pacific Railway and following this road for  $11\frac{1}{2}$  miles across the Grand River through Glenmorris and across the old main line of the Grand Trunk as far as the township line between South Dumfries and Brantford, in the County of Brant. It then angles across country for half a mile to meet the road allowance between lots 24 and 25 in concession 1 of Brantford, continuing along this road for two miles to tie in with the London-Brantford-Hamilton line at the proposed site of the Brantford interswitching station. The total distance from Preston by this route is 20 miles.

There is very little cross country line in this section, roads being followed for nearly the whole distance. The concession road through North Dumfries will require some clearing as the sides of the right-of-way are overgrown with fairly heavy timber for about 10 miles, but apart from this the roads used are very favorable, being little travelled and clear of artificial obstruction.

On this line there are two water crossings, neither of which will require special construction, although the crossing of the Grand River will require a span

somewhat longer than the standard. It will be necessary to cross four steam and two electric railways and two telephone lines. Several swamps are encountered and in one or two cases the crossing of them will entail a certain amount of special construction in connection with tower footings.

It will have been noticed that in the description of the various lines no detailed descriptions have been given of the line entrances to the different municipalities. It was thought advisable to omit these for several reasons, but principally owing to the part previously mentioned that the sub-station locations have so far been merely tentative, and until their location has been finally established through consultation with the various municipal authorities, no entrance location can be regarded as final.

#### SUMMARY OF MILEAGE AS SURVEYED.

Niagara Falls to main interswitching station .....	36 $\frac{1}{2}$	miles.
Main interswitching station to Toronto .....	41	"
Humber Bay to Toronto Junction .....	4 $\frac{1}{2}$	"
Main interswitching station to Guelph .....	37 $\frac{1}{2}$	"
Guelph to Hespeler .....	9 $\frac{1}{2}$	"
Hespeler to Preston .....	3 $\frac{1}{2}$	"
Preston to Berlin .....	7 $\frac{3}{4}$	"
Berlin to Waterloo .....	1 $\frac{1}{2}$	"
Waterloo to Stratford .....	25	"
Stratford to St. Mary's .....	11 $\frac{1}{2}$	"
St. Mary's to London (second line) .....	24	"
London to St. Thomas .....	14 $\frac{1}{2}$	"
London to Ingersoll .....	17	"
Ingersoll to Woodstock .....	9 $\frac{1}{2}$	"
Woodstock to Brantford .....	23 $\frac{1}{2}$	"
Brantford to main interswitching station .....	28 $\frac{1}{2}$	"
Preston to Galt .....	5 $\frac{1}{2}$	"
Preston to Brantford .....	20	"

#### SUPPLEMENTARY.

Owing to the method of charging for power which the generating company proposes to adopt, namely, a monthly charge based on the 20-minute maximum value of the peak load for each month, it is evident that during certain portions of each day the amount of power being actually used will be considerably less than the quantity upon which the monthly charge is based. The problem, therefore, was to evolve some means of using this spare power, the use of which would cost the system nothing.

Having this end in view a careful study of the problem is in progress and estimates are being prepared for the construction of what has been called a Hydraulic Accumulator system. Investigation is not sufficiently far advanced to furnish details of the scheme at present, but there is no doubt as to its feasibility from a structural and operating standpoint, and it only remains to ascertain whether or not its economic influence upon the transmission system will be sufficiently great to warrant serious consideration.

If the results of this investigation are such as to justify the opinion of your Chief Engineer, details of the scheme will be presented in a supplementary report, together with a recommendation for the construction of a plant on the site selected.

In this event, the accumulator plant and the main interswitching apparatus would be installed in the same building. This would mean altering the present assumed location of the interswitching station as indicated elsewhere in this report



and it would also involve some changes in the present location of the lines in the neighborhood of Hamilton. This arrangement would make the system in this locality much more compact and would greatly reduce operating charges. It would also obviate the necessity of carrying the Toronto line across Burlington Beach, the result being the elimination of the most difficult construction problem in the whole district.

In conclusion, it may be said that although in the future it may be deemed expedient to alter in detail some portions of the location assumed as final in the foregoing report, the lines as a whole are believed by your engineers to be located in such a way as to serve the municipalities involved equally and with a maximum of efficiency and reliability.

All of which is respectfully submitted.

(Signed),

P. W. SOTHMAN,

*Chief Engineer.*

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## ADDITIONAL SURVEYS IN THE NIAGARA POWER DISTRICT DURING THE YEAR 1908.

### AUTHORITY.

These surveys were undertaken in accordance with a resolution passed on May 5th, 1908 by the Commission, authorizing the Chief Engineer to place a survey party in the field "to engage in a survey of proposed changes in the transmission line."

Acting upon these instructions, preparations were immediately commenced for organizing the field party and beginning actual operations. There was practically no reconnaissance work necessary in this case, as the country had been fully covered during the previous season. The work was carried on without interruption till the middle of November, 1908, and a summary of the work accomplished will be found hereunder.

### CAUSES RELATING TO NECESSITY FOR FURTHER SURVEYS.

In the report on surveys for 1907, it will be remembered that the location of the lines and the manner of carrying out the work was based upon the following facts and assumptions:

- (1) The limiting voltage was to be 60,000.
- (2) Pin insulators were to be used.
- (3) The lines were to be located as far as possible upon the public roads.
- (4) No decision at that time had been reached as to whether cross-country right-of-way was to be acquired by outright purchase or by the easement plan.
- (5) Mesh protection was to be used.
- (6) It was originally intended that all municipalities involved in the transmission scheme were to be supplied direct from the high tension lines.

In the meantime, however, the suspended type of high tension insulator had passed the experimental stage and was being manufactured commercially. In view of the successful operation of various 80,000 and 100,000 volt lines in the Western States, your Commissioners deemed it advisable to make a careful investigation of the possibilities offered by this new type of construction. The facts and figures collected as a result of this investigation proved so satisfactory that it was considered justifiable not only to adopt the suspended type of insulator, but to raise the pressure to 110,000 volts, this being the highest voltage on any line yet built or projected. As a result, therefore, all specifications were prepared and tenders invited for the construction and equipment of a line having a transmission pressure of 110,000 volts.

As a result of this decision the transmission towers were considerably increased in height and base area and the length of cross arm increased to accommodate the wider conductor spacing necessary for the greater voltage. On account of this the scheme of mesh protection was abandoned as its construction under the new conditions would have involved an unreasonably large capital outlay and would have produced a dangerous strain in the towers as at present designed. The dimensions of the new towers and the overhanging conductors also did away with the possibility of locating the lines on the road allowance and the increased voltage precluded the possibility, in some cases, of carrying the high tension lines directly into the substation locations.

Conditions affecting the 1907 surveys as a result of the foregoing may be summarized as follows:

(1) All lines had to be located inside the fence lines and entirely off the road allowance.

(2) Line entrances hitherto considered safe for 60,000 volts with mesh protection had to be abandoned.

(3) Sections of road hitherto considered suitable had to be abandoned in view of the large number of houses and other artificial obstructions located near the fence lines.

(4) The limitation mentioned in clause 2 above was overcome by establishing centrally located transformer stations which are designed to serve by radial low tension distribution, such municipalities as are within economical transmission distance of the various stations. This resulted in a material reduction in high tension mileage and a subsequent abandonment of high tension location as established by the surveys of 1907; also owing to the necessary changes in route, a considerable amount of entirely new survey was required.

Another cause for a material alteration in line location was the moving of the site of the main interswitching station from Stony Creek to the site of the proposed hydraulic accumulator plant near Dundas. This change not only involved the abandonment of the line across Burlington Beach, and a new survey around the head of Burlington Bay, but also that portion of the line which paralleled the transmission of the Toronto-Niagara Power Company. The only reason for adopting this line originally was to swing the line north to reach the Beach crossing. With this crossing eliminated, however, there was no other logical course than to locate a new line following the roads as much as possible, which was accordingly done.

It will be seen from the foregoing what effect these radical changes in the general scheme had upon the line locations as established in 1907, and what urgent necessity there was for the supplementary surveys undertaken in 1908 upon the recommendation of your Chief Engineer.

#### DIVISION INTO SECTIONS.

For the most part the district was divided into much the same sections as in 1907, the divisions at present in use being as follows:—

Section A.—From Niagara Falls to main interswitching station near Dundas.

Section B.—From main interswitching station to Toronto.

Section C.—From main interswitching station to the western limits of Brantford Township.

Section D.—From Brantford Township to Woodstock.

Section E.—From Woodstock to London.

Section F.—From main interswitching station to Guelph.

Section G.—From Guelph to Stratford *via* Preston and Berlin.

Section H.—From London to Stratford.

Section I.—From London to St. Thomas.

#### SECTION A.—NIAGARA FALLS TO MAIN INTERSWITCHING STATIONS.

Beginning at the western limits of the City of Niagara Falls, the original survey ran for  $5\frac{3}{4}$  miles straight across country to a point on the Welland Canal near Allanburg. As this line is somewhat inaccessible it was deemed advisable to



run an alternative line which should follow the roadway as far as possible to the same point on the canal. This new portion of the line was therefore surveyed and was found to be  $6\frac{1}{2}$  miles long. Owing to the difficulty of securing right-of-way along this new line and the extra cost of construction, it may be abandoned for the original route.

From Welland Canal to Gainsboro Township the route of the previous year has been followed as it is the most direct, and also because very favorable crossings of the Welland Canal and the St. John's Valley had been selected. From here, to the end of the section, owing to the shifting of the main interswitching station from Stony Creek to Dundas, and also to the desirability of keeping as far as might be from other transmission lines, an entirely new route has been surveyed.

Upon reaching Gainsboro Township, the new line, instead of making an angle towards the north as in the previous survey, continues in the same general direction along the roadway between concessions 5 and 6 of this township, then along the roadway between concessions 6 and 7 of Caistor Township. From here it follows the roadway between concessions 1 and 2 of Binbrook and Glanford Township to Ancaster Township, where it deflects to the north. Passing over this escarpment southwest of Hamilton, it crosses the Des Jardins Canal and continues across country to the main interswitching station.

With the exception of the crossing of the St. John valley and of the section near the Des Jardins Canal, the country along the whole of the route is comparatively level and well adapted for line construction. This new route from the Welland Canal to the interswitching station has the further advantage of following roadways for over 83 per cent. of its length. The entire distance from the city limits of Niagara Falls to the interswitching station is  $52\frac{3}{4}$  miles. In this distance the line crosses four steam railways, three electric railways, two canals and five high tension power lines.

#### SECTION B.

From Dundas Station to Nelson Township an entirely new route has been surveyed. The section of country lying between these two points is the roughest encountered on any of the systems, and exceptional care was necessary to select the most suitable route. The line as surveyed is considered to be the best and most direct possible and is much better than was at first hoped for, the crossing of the Waterdown Creek being the only difficult part of the route.

As the line leaves the Dundas Station, it deflects slightly to the north, then runs through East Flamboro Township along the foot of the hills to Nelson Township, where it meets the original line between concessions 1 and 2 of that township. From this point on the line remains practically the same as originally surveyed, there being only a few minor changes where the line is offset slightly from its original position. About 50 per cent. of this line is along roadways, the total distance being  $37\frac{1}{4}$  miles.

In this section the line crosses one steam railway and one high tension transmission line. There are also four somewhat difficult crossings of river valleys, but with the exception of these and the section in East Flamboro, the country is practically level and very favorable for a transmission line.

#### SECTIONS C AND D.

Owing to the new system of distribution it was not necessary to carry the high tension line to the City of Brantford. An entirely new survey was therefore made of Sections C and D, the new line being much more direct than the original one.

On leaving Dundas Station the new route parallels Section A to the line between concessions 1 and 2 of Ancaster Township, which it follows to Brantford Township. From here it follows the roads between concessions 1 and 2 of Brantford, Burford and East Oxford to the City of Woodstock, a total distance of  $46\frac{3}{4}$  miles, about 80 per cent. of which is along roadways.

In this section there are crossings of two electric railways, one high tension power line and five steam railways.

#### SECTION E.

An entirely new route has been surveyed for this section as it was unnecessary to carry the high tension line to Ingersoll. On leaving the city limits of Woodstock, the line runs across country to the road between concession 1 and the broken front of West Oxford. The road is followed past Beachville, where the line turns north across country to the road between concessions 2 and 3 of North Oxford. The line continues to the end of this road and about two miles from the City of London, where it deflects across country to the transformer station, a total length of  $25\frac{3}{4}$  miles. This line has the advantage over the old of being somewhat shorter and of following along roadways for over 80 per cent. of its entire length.

#### SECTION F.

Owing to the new conditions this line was also altered, only about six miles in East Flamboro being along the original survey.

The line as at present laid out, leaves the Dundas Station running west for a short distance along a road allowance, then north over the escarpment, continuing north along roadways to the road between East and West Flamboro. Here it encounters a telephone line which it is proposed to have removed. It continues along this roadway to a point beyond Freelon where it deflects easterly, running across country to the road along the west side of concession 7 of Puslinch Township. Near the north end of this road the line deflects slightly to the east, running across country to the city limits of Guelph. This line crosses two steam railways. The total length is  $25\frac{1}{4}$  miles, 66 per cent. of which is along roadways. The country for the most part is very rolling, but with the exception of that part running over the escarpment near the Dundas Station the hills will entail no special construction.

#### SECTION G.

As it was unnecessary to touch Hespeler, Waterloo or New Hamburg, a route somewhat better than the original was surveyed, although the total length was only slightly reduced.

On leaving the city limits of Guelph, the line runs south-westerly across the Speed River to the Waterloo Road, which it follows to a point near the western limits of Guelph Township. From this point it deflects to the south, following the Hespeler Road, and this road produced to a point a short distance north of the Speed River. Here the line deflects to the west and follows the river valley to the Preston Station. From Preston it runs north-westerly, partly across country and partly along roadways in as direct a line as practicable to the Berlin Station.

Leaving the Berlin Station the line runs westerly across country to the Erb Road. Following this road and the road through Brocksden to a point near Stratford, the line deflects across country, entering the latter city from the south-east.

On this line are two electric and five steam railway crossings. There is also a river crossing requiring special construction. The line is  $48\frac{1}{4}$  miles long and follows roadways for 55 per cent. of this distance. For the greater portion the country is rolling, but not sufficiently hilly to interfere with the building of the line or to make patrol especially difficult.

#### SECURING RIGHT OF WAY.

Early in the spring of 1908 preparations were begun for the securing of right of way. After taking all things into consideration it was decided to secure easement privileges for the land to be occupied by the transmission line, as it was considered that such a course would be the least objectionable from the owners' point of view.

The line built by the Grand Rapids Muskegon Power Co., being very similar to that contemplated by the Commission, was inspected during the last week in April, 1908, by Engineer Acres, accompanied by three land buyers. Notes were taken on the prices paid and the methods used for securing right of way and also on the general construction of the line.

One month later the actual work of securing right of way was begun, one land buyer accompanied by an engineer being sent to the Niagara section, the Toronto section and the London section, respectively, with the object of making a study of conditions and getting information that would lead to the establishing of suitable prices and incidentally to make what agreements they could, at the time, with the owners.

A scale of prices was finally arranged and adhered to throughout the whole of the work. Prices were set for tower privileges, a certain amount being offered for the privilege of erecting and maintaining each tower with its accompanying wires, etc., the price depending upon the value of the land and the location of the tower. A similar scale of prices was also made for patrol privileges, where such was necessary, and above this a sum was paid for the right to cut trees and to remove other obstructions.

The agreement for tower, patrol and other privileges were made for a term of thirty years with the right to renew at the expiration of this time, payment covering the thirty-year period for all the above items, to be made at the beginning of such period.

The task of securing right of way was an extremely difficult one. A commercial company could send agents quietly through the country securing rights to erect towers at the least price that could be arranged, whereas it was necessary that the Commission deal with everyone with absolute fairness and treat all alike.

A number of agreements were made with the understanding that a portion of the tower footing be on the roadways.

It was found that considerable opposition would be made to building any portion of the towers on road allowances and considerable mistrust was occasioned when the land buyers returned to readjust such agreements, the owners, in some cases, believing that the first agreement was made simply with the object of leading them on to sign others.

To add to these difficulties those opposing the work of the Commission sent agents throughout the country distributing literature and doing everything possible to raise distrust amongst the farmers and nullify the work of our land buyers.



## PURCHASE OF POWER.

By-laws for the purpose of giving various Councils power to negotiate with your Commission for a supply of electrical energy were submitted throughout the Province. These by-laws were carried in every municipality by a large majority, as follows: Toronto, Hamilton, London, Brantford, Stratford, St. Thomas, Toronto Junction, Guelph, Galt, Woodstock, Ingersoll, St. Mary's, Waterloo, Preston, Hespeler, Weston and Paris. The result of this vote was conclusive and showed that the chief industrial centres of the Province had abundantly justified the Commission in the work so far undertaken.

As the result of this substantial endorsement the Commission then took up the question of the purchase of the power at the Generating Plant. Tenders were asked for from the Canadian Niagara Power Co., The Ontario Power Co., The Electrical Development Co., and the Erie & Ontario Development Co. These were considered with great care, and contract was finally awarded The Ontario Power Co.

After lengthy negotiations with this Company, the following agreement was entered into, dated 12th August, 1907:

This agreement, made this 12th day of August, 1907, between the Hydro-Electric Power Commission of Ontario, acting herein on its own behalf and with the approval of the Lieutenant-Governor in Council, (hereinafter called the "Commission"), party of the First Part, and The Ontario Power Company of Niagara Falls, incorporated by the Parliament of the Dominion of Canada, under and by virtue of Act 1887, 50-51 Victoria, Chapter 120; Act 1891, 54-55 Victoria, Chapter 126; Act 1893, 56 Victoria, Chapter 89; Act 1899, 62-63 Victoria, Chapter 105; Act 1900, 63-64 Victoria, Chapter 115, and Act 1902, 2 Edward VII., Chapter 86, (hereinafter called the "Company"), party of the Second Part.

Whereas, the Commission is duly incorporated under the provisions of an Act passed by the Legislature of the Province of Ontario, in the sixth year of His Majesty King Edward VII., and chaptered 15, and under the provisions of said Act is authorized to contract with any Company generating electrical power or energy for a supply of electrical power or energy to the Commission;

And whereas, the Company, under the provisions of the Statutes of Canada, above recited, and under the provisions of certain agreements dated April 11, 1900, August 15, 1901, June 28, 1902, and February 28, 1903, between the Company and the Commissioners of the Queen Victoria Niagara Falls Park, to which agreements reference is specifically made, has constructed a series of works in the vicinity of Niagara Falls, Ontario, in which the Company is now generating electrical power, and is prepared to sell and deliver the same in the quantities hereafter mentioned;

And whereas, the Commission invited tenders for electric power to be supplied at or near the Niagara Falls, and the Company made the lowest tender for the supply of power to the Commission for their purposes under the provisions of the said Act;

And whereas, certain municipalities have applied to the Commission for the maximum price of such power at Niagara Falls, and for estimates of the cost of transmission to the said municipalities;

And whereas, the estimates of the Commission will be based in part upon this agreement, and the Commission will be required to devote time and skill and expend moneys in the preparation of such estimates, and such estimates are to be used by said municipalities for the purposes fully set forth in said Act;

And whereas, the Commission has declined other tenders and has decided to accept the tender of the said Company under the terms of this agreement;

Now therefore in consideration of the premises and of the mutual covenants and agreements herein contained and of other valuable considerations the parties hereto have mutually agreed, and do each agree with the other, as follows:—

1. The Company hereby agrees:—

(a) At the expiration of ninety days' notice in writing by the Commission to the Company to deliver eight thousand (8,000) horse power or more to the Commission and the Commission hereby agrees to purchase and pay for the same.

(b) At the expiration of three months' like notice to deliver from time to time to the Commission in blocks of not less than one thousand (1,000) horse power each, additional power until the total so delivered shall amount to thirty thousand (30,000) horse power, and the Commission hereby agrees to purchase and pay for the same.

(c) At the expiration of nine months' like notice to deliver from time to time in like blocks additional power until the total so delivered shall amount to one hundred thousand (100,000) horse power, and the Commission agrees to purchase and pay for the same.

2. The Commission agrees to take power exclusively from the Company up to the said 30,000 horse power, and also in addition thereto, one-half of the amount of power required by the Commission up to the said 100,000 horse power: thereafter the Commission may, at its option, take power from other sources.

3. The Company hereby agrees to deliver and the Commission to purchase and pay for the said several quantities of horse power on the terms and conditions of this agreement as hereinafter provided.

4. This agreement shall remain in force for ten years from the date of the expiration of the said ninety days' notice. The Commission may at its option continue this agreement for one, two or three further consecutive terms of ten years each by giving notice in writing of their intention to continue this agreement for the second term of ten years, at least three years before the expiration of the first term of ten years, and if the term be thus extended on giving notice of their intention to continue this agreement for the third term of ten years by giving a like notice at least three years before the expiration of the second term of ten years, and if the term be then extended on giving notice of their intention to continue this agreement for the fourth term of ten years by giving a like notice at least three years before the expiration of the third term of ten years. This agreement shall not in any event extend beyond 1st April, 1950, the date at which the first term of years of the above recited agreement of the Company with the Commissioners of the Queen Victoria Niagara Falls Park, dated the 11th April, 1900, will expire.

5. This agreement is entered into subject to the provisions of the Power Commission Act and neither the making of this agreement nor anything herein contained shall in any way limit or prejudice any right and power which the Commission may now have to expropriate the plant and apparatus of the said Company or any part thereof or the power generated by the said Power Company

or any other Power Company, but nothing in this agreement shall be taken to give or enlarge any such power.

6. The electrical power herein contracted for shall be three-phase, alternating, commercially continuous twenty-four hour power every day of the year, except as provided in paragraph hereof.

7. It is hereby agreed by and between the parties hereto that the maintenance by the Power Company of approximately the agreed frequency at the line switch or switches of the Company shall constitute the delivery of all power involved herein and the fulfilment of all operating obligations hereunder, and that when voltage and frequency are so maintained the amount of the power, its fluctuations, load factor, power factor, distribution as to phases and all other electrical characteristics and qualities are under the sole control of the Commission, its agents, customers' apparatus, appliances and circuits.

8. The Company shall at all times use first-class modern, standard, commercial hydro-electric power apparatus and plant and the power shall be delivered at approximately 60,000 volts and at approximately twenty-five cycles per second, and the company shall use first-class modern standard regulating apparatus and all due skill and diligence to maintain the power at such voltage and frequency.

9. The several blocks of power herein provided for shall be the amounts which the Company shall from time to time hold in reserve ready for the Commission, and the Commission shall not at any time take more than the amount so held in reserve for it.

The Commission shall so take power that the kilo-volt amperes so taken shall not at any time exceed by more than 5 per cent. the kilowatts held in reserve for it, and this provision shall apply proportionately to each circuit and phase.

10. The power herein provided for shall be measured by curve-drawing meters. These meters shall be subject to test as to accuracy by either party hereto.

The Commission shall pay for three-fourths of the power held in reserve for it, as herein provided, whether it takes the same or not.

When the greatest amount of power taken for any twenty (20) consecutive minutes during any month shall exceed three-fourths of the amount at that time held in reserve for the Commission, then it shall pay for this greater amount during that entire month.

11. The point of delivery shall be the property-line between the Company's Distributing Station and the right-of-way of the Michigan Central R.R. at Niagara Falls, Ontario, Canada, and at this point the Commission shall have the right to erect and maintain its initial line structure or structures.

12. In case the Company shall be prevented from delivering said power, or in case the Commission shall be prevented from taking said power, by strike, lock-out, riot, fire, invasion, explosion, act of God, or the King's enemies, or any other cause reasonably beyond their control, then the Company shall not be obligated to deliver such power during such period: and the Commission shall not be obligated to pay for such power during such period; but nothing herein contained shall be construed as permitting the Company to refuse to deliver power, or the Commission to refuse to take the same as soon as the cause of interruption is removed, and each of the parties hereto shall be prompt and diligent in removing and overcoming such cause or causes.

13. If interruptions occur in the service of the Company due to causes other than above, deductions shall be made as follows:—For interruptions less than one hour, double the amount payable for power for the time of such default, and for interruptions of one hour or more, the amount otherwise payable for the day.



14. The Commission and its customers shall select and use transformers and all apparatus most suitable to receive the electric power produced by the apparatus of the Company, and the Commission's transmitting, transforming, translating and all other apparatus and devices upon its circuits shall be of standard design and construction and shall be operated and maintained with special reference to securing the highest efficiency and most perfect operation, not only of its own, but also of the apparatus of the Company when receiving power from the Company; and the Commission shall instal upon and equip its circuits with such approved protective devices as are in commercial use and operate its circuits in such a manner as will to the then greatest extent protect the apparatus and circuits of the Company from damage and interruption by lightning, short circuiting or otherwise, so as to save harmless the Company from any damage that may arise in the use of the said power supplied by the Company to the said Commission.

After the happening of any of the events provided for in paragraphs 12 and 13 power shall be delivered first to the Commission before re-establishing power to any other customer or customers of the Power Company, provided that the Commission's lines are ready to receive such power.

15. It is recognized by both the parties hereto that the state of the art or production and transmission and application of electrical energy is subject to constant advance, and that it is impossible by contract to cover all requirements and conditions which time may develop, and the Company and the Commission with the approval of the Lieutenant-Governor-in-Council while adhering to the provisions of this agreement, will at any time upon the request of the other, take up and in good faith fairly consider, with the aid of their respective engineers, any features or changes of the system as a whole of the modifications of any of the provisions hereof, provided it shall appear to the party to whom such request is made that compliance therewith shall tend to make this agreement more effective and to make the venture of each party more successful and certain; provided, however, that any such action, or the failure on the part of either party to require of the other exact conformity to the provisions hereof, or any liberty or greater latitude beyond the provisions of this agreement permitted by either party to the other, in the course of the co-operation implied by the spirit of this agreement, shall in no manner act as or constitute a precedent or amend or change the obligations of the parties hereto.

16. The Commission hereby agrees to pay to the Company for such power delivered under the terms of this agreement, the sum of ten dollars and forty cents (\$10.40) per horse power per annum when the amount reserved and held ready, upon the order of the Commission, for delivery under the terms hereof, is less than twenty-five thousand (25,000) horse power, and when the amount reserved and held ready for delivery upon like order exceeds twenty-five thousand (25,000) horse power, the Commission agrees to pay the sum of ten dollars (\$10) per horse power per annum. The power shall be paid for monthly in gold coin of the present standard weight and fineness, in twelve amounts, in each year at the office of the Company in Niagara Falls, Ontario, and bills shall be rendered for such payments on the first, and be paid on or before the fifteenth of each month.

17. At any time that the quantity of power which is being taken under this agreement by the Commission shall amount to sixty per cent. or more of the total power which the Company is developing and a complaint is then made in writing by the Commission to the Company that the Company has so continuously neglected or failed to perform the terms of this agreement that the apparatus

of the Commission or its customers cannot by reason of such neglect or failure of the Company be operated to full efficiency and the Company shall not within a reasonable time remedy such neglect or failure then the matter of complaint may be referred to the arbitrators appointed as hereinafter stated, and if the said arbitrators shall determine that there is a just ground of complaint they may by their award direct that the Company shall remedy such neglect or failure within a time to be fixed by the award, and if such neglect or failure be not remedied as directed by the said award the arbitrators may order that upon such terms as they deem reasonable including the rights of the other parties interested the whole of the plant, apparatus and property of the Company shall be transferred to the Commission, whereupon on payment and satisfaction of the said terms the Commission may, with the approval of the Lieutenant-Governor-in-Council, take over the said plant, apparatus and property, and the same shall be transferred to the Commission.

18. It is hereby declared and agreed that in case the plant, apparatus, buildings or premises of the Company or any part thereof shall at any time during the continuance of this agreement be damaged or destroyed so as to prevent the Company from supplying the said power of the quantity and quality hereinbefore provided for to the Commission and the Company is unable to supply the said power within a reasonable time to be fixed if necessary by the said arbitrators, the Commission may, with the approval of the Lieutenant-Governor in Council, terminate this agreement, and any questions as to terms or conditions connected with such determination of the agreement shall be settled by the said arbitrators.

19. It is further agreed by and between the parties hereto that, in case any dispute shall arise relating to the question of the performance or fulfilment of any of the terms, provisos or conditions of this agreement, or as to the method or accuracy of the measurement of the power or as to any other question which may arise under this agreement, the same shall be finally determined by two independent persons, one to be chosen by each of the parties to such dispute, and such arbitrators shall, before proceeding with the reference, appoint a third arbitrator to act with them, and the decision of the said three arbitrators or a majority of them shall be conclusive on both parties, and in case either of the said parties shall neglect or fail to appoint an arbitrator within thirty days after the request in writing by the other party, then the arbitrator appointed by the other party may proceed alone, and his award shall be conclusive on all parties. The award shall be made within four months after the appointment of the first of such arbitrators and, in the event of the two arbitrators appointed, as aforesaid, being unable or unwilling to agree upon a third arbitrator for two weeks after their appointment or the appointment of the one of them who was last appointed, then such third arbitrator shall be chosen and appointed by the Chief Justice for the time being of the King's Bench Division of the High Court of Justice for the Province of Ontario, or in the event of the Chief Justice being sick, absent from the Province, or otherwise unable or refusing to act, then such third arbitrator shall be appointed by any Judge of the High Court of Justice other than a local judge. It is agreed that there may be an appeal by either party from any decision or award of such arbitrators to the High Court of Justice for Ontario in accordance with the provisions of the Arbitration Act in that behalf.

20. Notwithstanding that there may be differences between the parties which may embrace the question of the supply or sufficiency of the power or the

payment therefor or any other questions whatever that may arise under this agreement the Company shall continue to deliver the power and the Commission to pay therefor and both parties shall continue to carry out the contract notwithstanding such differences, and when the matters which may be in issue shall be finally determined by the reference as above provided, the parties shall deal with such matters according to the terms of the award that may be made on such reference. It being the distinct agreement between the parties that there shall not be during the period of the agreement any stoppage or cessation in the carrying on of the work, but that the same shall be continuous and any matters in difference shall not form a reason for interfering with the same but shall be accommodated in the manner herein provided.

21. The Company will not, directly or indirectly, deliver power in Ontario to any person or corporation that it is intended shall be supplied by the Commission under this agreement.

In case any difference arises as to such supply the same shall be settled by the said arbitrators.

This clause shall not, however, be held to cover or interfere with the supply of power agreed to be delivered by the said Company to any persons or corporations other than the Commission at the date on which the first block of power is ordered by the Commission from the Company under this agreement, but the said supply shall continue unaffected by this agreement.

22. The Company agrees that it will not exercise the right to cancel contained in the said agreement dated 11th April, 1900.

23. This agreement shall extend to and be binding upon and enure to the benefit of the successors and assigns of the parties hereto.

24. This agreement shall have no force or effect until approved by the Lieutenant-Governor-in-Council.

In witness whereof the said Commission has affixed its corporate seal and has signed, sealed and executed the present agreement; and the Company acting by and through its President and secretary duly authorized for all purposes hereof has hereunto affixed its corporate seal under the hands of the President and Secretary.

(Seal.)

A. BECK.

JOHN S. HENDRIE.

W. K. McNAUGHT.

THE ONTARIO POWER COMPANY OF NIAGARA FALLS.

J. J. ALBRIGHT,

President.

ROBERT C. BOARD,

Secretary.

(Seal.)



## AMENDED AGREEMENT WITH THE ONTARIO POWER COMPANY.

All of the estimates made previous to the year 1908 had been made on the basis that the power would be transmitted to the various Transformer Stations at 60,000 volts, but after careful consideration and investigation as to the advisability of extending the area of distribution, and in view of the successful operation of a number of Transmission Plants at a potential of 80,000 volts your Commissioners deemed it necessary to go further into the question of increasing the potential of transmission. The information obtained, after careful research, proved so favorable for the higher potential that it was adopted. Negotiations were opened with the Ontario Power Company for the supply of Power at 110,000 or 112,000 volts instead of 60,000 volts. After several conferences the following agreement was entered into on March 8th, 1908:—

This Agreement made the nineteenth day of March, 1908, between The Hydro-Electric Power Commission of Ontario, acting herein on its own behalf and with the approval of the Lieutenant-Governor-in-Council (hereinafter called the "Commission") Party of the first Part, and The Ontario Power Company of Niagara Falls (hereinafter called the "Company") Party of the Second Part.

Whereas the Commission invited tenders for electric power to be supplied at or near the Niagara Falls, and the Company made the lowest tender for the supply of power to the Commission for their purposes under the provisions of the Power Commission Act.

And whereas certain municipalities have applied to the Commission for the maximum price of such power at Niagara Falls and for estimates of the cost of transmission to the said municipalities.

And whereas the estimates of the Commission will be based in part upon this agreement, and the Commission will be required to devote time and skill and expend moneys in the preparation of such estimates, and such estimates are to be used by said municipalities for the purposes fully set forth in the said Act.

And whereas the Commission declined other tenders and accepted the tender of the Company and entered into the agreement hereto attached, but it was provided that certain additions might be made to the said agreement, and the parties have agreed to vary the said agreement in the manner hereinafter set forth.

Now therefore, this Indenture witnesseth that in consideration of the premises and of the mutual covenants and agreements herein contained, the parties hereto have mutually agreed and do each agree with the other as follows:—

1. That, except in so far as the said agreement is modified by this present agreement the same shall stand and be of full force, virtue and effect and binding between the parties.

2. The Company hereby agrees:—

(a) At the expiration of ninety days' notice in writing by the Commission to the Company to deliver eight thousand (8,000) horse power or more of electric power to the Commission:

(b) At the expiration of three months' like notice which may be given from time to time during the continuance of this agreement to deliver from time to time

to the Commission in blocks of not less than one thousand (1,000) horse power each, additional electric power until the total amount so delivered shall amount to thirty thousand (30,000) horse power.

(c) At the expiration of nine months' like notice, which may be given from time to time during the continuance of this agreement, to deliver from time to time to the Commission in like blocks, additional electric power until the total so delivered shall amount to one hundred thousand (100,000) horse power.

(d) The Commission shall not be bound to take or pay for any electric power until notice shall have been given as above provided.

(e) The Commission agrees to use all diligence by every lawful means in its power to procure such a demand from the municipalities, corporations, companies or persons for the power dealt with by this agreement so that at as early a date as possible the Commission will be in a position to give the notice above referred to to the Company for the supply of power in question, and if notwithstanding the exercise of all such reasonable diligence the Commission is not able within a period of eighteen months from the date of this agreement to give such notice, then the Company shall be at liberty to determine the agreement and it shall thereupon be no longer binding upon the parties hereto.

(f) The Commission agrees to take power exclusively from the Company up to the said 30,000 horse power, and also in addition thereto one-half of the amount of power required by the Commission up to the said 100,000 horse power; thereafter the Commission may, at its option, take power from other sources.

3. The Company hereby agrees to deliver, and the Commission agrees to purchase and pay for the said several quantities of electric power on the terms and conditions of this agreement.

4. The Commission hereby agrees to pay to the Company for such power so delivered under the terms of this agreement at the rate of \$9.40 per horse power per annum for power at 12,000 volts, and at the rate of \$10.40 per horse power per annum for power at 60,000 volts, and when the amount reserved and held ready for delivery upon the order of the Commission is in all, 25,000 horse power or more, payment shall be made at the rate of \$9.00 per horse power per annum for power at 12,000 volts, and at the rate of \$10.00 per horse power per annum for power at 60,000 volts. If power is taken at a higher voltage than 60,000 volts the price shall be determined as hereinafter provided. The power shall be paid for monthly in gold coin of the present standard of weight and fineness in twelve amounts in each year at the office of the Company at Niagara Falls, Ontario, and the bills shall be rendered by the Company on the first and paid by the Commission on or before the fifteenth of each month.

5. The Commission shall pay for three-fourths of the power ordered by the Commission and held in reserve for it as herein provided whether it takes the same or not.

6. When the greatest amount of power taken for any twenty consecutive minutes during any month shall exceed three-fourths of the amount during such twenty consecutive minutes ordered by the Commission and held in reserve, then the Commission shall pay for this greater amount during that entire month.

7. The point of delivery shall be the property line between the Company's distributing station and the right-of-way of the Michigan Central Railway at Niagara Falls, Ontario, Canada, and at or near this point on the Company's land the Commission shall have the right to erect and maintain during the continuance of this agreement its initial line structure or structures.

8. This agreement shall remain in force for ten years from the date of the expiration of the said ninety days' notice. The Commission may, at its option, continue this agreement for one, two or three further consecutive terms of ten years each by giving notice in writing of its intention to continue this agreement for the second term of ten years, at least three years before the expiration of the first term of ten years, and if pursuant to such notice this agreement is continued, by giving notice of its intention to continue this agreement for the third period of ten years at least three years before the expiration of the second term of ten years, and if pursuant to such last mentioned notice this agreement is continued, by giving notice of its intention to continue this agreement for the fourth term of ten years at least three years before the expiration of the third term of ten years. This agreement shall not in any event extend beyond the 1st of April, 1950, the date at which the first term of years of an agreement of the Company with the Commissioners of the Queen Victoria Niagara Falls Park dated eleventh April, 1900, will expire.

9. The electric power herein contracted for shall be three-phase alternating, commercially continuous twenty-four hour power every day of the year except as provided in paragraph 17 hereof.

10. It is agreed that the maintenance by the Company of approximately the agreed voltage at approximately the agreed frequency at the line switch or switches of the Company shall constitute the delivery of all power involved herein and the fulfilment of all operating obligations hereunder: and that when voltage and frequency are so maintained, the amount of the power, its fluctuations, load factor, power factor, distribution as to phases, and all other electric characteristics and qualities are under the sole control of the Commission, its agents, customers, apparatus, appliances and circuit.

11. That several blocks of power herein provided for shall be the amounts which the Company shall from time to time hold in reserve upon the order of the Commission and the Commission shall not at any time take more than the amount so ordered and held in reserve for it.

12. The Commission shall so take power that the kilo volt amperes so taken shall not at any time exceed by more than ten per cent. the kilowatts held in reserve for it and this provision shall apply proportionately to each circuit and phase.

13. The Company shall at all times use first-class, modern, standard, commercial hydro-electric power apparatus and plant and the power shall be delivered at approximately 12,000 volts or approximately 60,000 volts unless otherwise agreed as hereinafter provided, and at approximately 25 cycles per second, the Company shall use first-class, modern, standard regulating apparatus and all due skill and diligence to maintain the power at such voltage and frequency. The Commission may require part of the said power to be delivered at more than 60,000 volts and the Company shall be entitled to have the price for such higher voltage increased to such an extent as shall be relatively the equivalent, but without increased profit, to the price of power delivered at 60,000 volts, and in case the Company and the Commission cannot fix the higher voltage and the price to be paid therefor, the voltage may be fixed and the price to be paid determined under the Arbitration Act, Revised Statutes of Ontario, 1897, Chapter 62, in a summary manner and without appeal. Notwithstanding any award the Commission may decide to take power at 12,000 or 60,000 volts, but in that event the Commission shall pay all costs of said arbitration. The Commission shall with the ninety days' notice before mentioned specify in writing to the Company



that the power is to be delivered at not more than two of the said voltages or partly at one of the two and partly at the other voltage, and the Company shall deliver power or at the same time a certain part of the power at one voltage, and a certain part at the other so specified. The Commission may from time to time vary the quantities to be delivered at the specified voltages and thereupon the Company shall deliver the said power as varied, but the price for the power specified at the higher voltage shall not be reduced if the power is taken at the lower voltage. If part of the power is specified at a voltage higher than 60,000 volts the Commission shall give one year's notice instead of ninety days' notice for that part of such power.

14. The Commission and its customers shall select and use transformers and all apparatus most suitable to receive the electric power produced by the apparatus of the Company and the Commission's transmitting, transforming, translating and all other apparatus and devices upon its circuits when receiving power from the Company shall be of modern, standard design and construction and shall be operated and maintained with special reference to securing the highest efficiency and most perfect operation not only of its own but also of the apparatus of the Company when receiving power from the Company; and the Commission shall instal upon and equip all circuits with such approved protective devices as are in commercial use and operate its circuits in such a manner as will to the then greater extent protect the apparatus and circuits of the Company from damage and interruption by lightning, short-circuiting or otherwise, so as to save harmless the Company from any damage that may arise in the use of the said power supplied by the Company to the said Commission.

After the happening of any of the events provided for in paragraphs 17 and 22, power shall be delivered first to the Commission before re-establishing power to any other customer or customers of the Power Company, provided that the Commission's lines are ready to receive such power.

15. The power herein provided for shall be measured by curve-drawing meters. These meters shall be subject to test as to accuracy by either party hereto.

16. The Engineers of the Commission, or one or more of them, or any other person or persons appointed for this purpose by the Commission, shall have the right from time to time during the continuance of this agreement to inspect the apparatus, plant and property of the Company and take records at all reasonable hours on giving to the Company six hours' notice of the intention to make such inspection. The Company shall have a like right on giving a like notice to inspect the apparatus, plant and property of the Commission and of the municipalities, companies and persons who are using power supplied by it through or to the Commission.

17. In case the Company shall at any time or times be prevented from delivering said power, or any part thereof, or in case the Commission shall at any time be prevented from taking said power, or any part thereof, by strike, lock-out, riot, fire, invasion, explosion, act of God or the King's enemies, or any other cause reasonably beyond their control, then the Company shall not be bound to deliver such power during such time and the Commission shall not be bound to pay for such power during such time, but as soon as the cause of such interruption is removed the Company shall without any delay deliver the said power as aforesaid and the Commission shall take the same and each of the parties hereto shall be prompt and diligent in removing and overcoming such cause or causes of interruption.

18. If and so often as any interruption shall occur in the service of the Company due to any cause or causes other than those provided for by the next preceding paragraph hereof, the Company shall pay to the Commission as liquidated and ascertained damages, and not by way of penalty, as follows:—For any interruptions less than one hour double the amount payable for power which should have been delivered during the time of such interruption, and for any interruption of one hour or more, the amount payable for the power which should have been delivered during the time of such interruption and twelve times the last mentioned amount in addition thereto and all moneys payable under this paragraph when the amount thereof is settled between the parties may be deducted from any moneys payable by the Commission to the Company under this agreement, but such right of deduction shall not in any case delay the monthly payments for power contracted for by this agreement.

19. It is recognized by both the parties hereto that the state of the art of production, transmission and application of electric energy is subject to constant advance, and that it is impossible by contract to cover all the requirements and conditions which time may develop; the Company and the Commission with the approval of the Lieutenant-Governor in Council while adhering to the provisions of this agreement will at any time upon the request of the other take up and in good faith fairly consider with the aid of the respective engineers any features or changes of the system as a whole or any modifications of any of the provisions hereof provided it shall appear to the party to whom such request is made that compliance therewith shall tend to make this agreement more effective and to make the venture of each party more successful and certain; provided, however, that any such action or the failure on the part of either party to require of the other exact conformity to the provisions of this agreement, or any liberty or greater latitude beyond the provisions of this agreement allowed by either party to the other in the course of the co-operation implied by the spirit of this agreement shall in no manner operate as or constitute a precedent or amend or change the obligation of the parties thereto.

20. This agreement is entered into subject to the provisions of the Power Commission Act and neither the making of this agreement nor anything herein contained shall in any way limit or prejudice any rights and powers which the Commission may now have to expropriate the plant and apparatus of the said Company or any plant thereof or the power generated by the said Power Company, or any other power company, but nothing in this agreement shall be taken to give or enlarge any such power.

21. It is agreed that in case any dispute shall arise relating to the question of the performance and fulfilment of any of the terms, provisos or conditions of this agreement, or as to the method or accuracy of the measurement of the power, or as to any question which may arise under this agreement, or as the rights of any of the parties after the termination of this agreement, under paragraph 22, the same shall be determined by two independent persons, one to be chosen by each of the parties to such dispute, and such persons before proceeding with the reference shall appoint a third arbitrator to act with them, and the decision of the said three arbitrators, or a majority of them, shall be conclusive on both parties except as hereinafter provided, and in case either of the said parties shall neglect or fail to appoint an arbitrator within thirty days after the request in writing by the other party then the arbitrator appointed by the other party may proceed alone and his award shall be conclusive on both parties except as herein-

after provided. The award shall be made within four months after the appointment of the first of such arbitrators, and in the event of the two arbitrators appointed as aforesaid being unable or unwilling to agree upon a third arbitrator for two weeks after their appointment, or the appointment of the one of them who was last appointed, then said third arbitrator shall be chosen and appointed by the Chief Justice for the time being of the King's Bench Division of the High Court of Justice for the Province of Ontario, or in the event of the said Chief Justice being ill, absent from the Province or otherwise unable or refusing to act, then such third arbitrator shall be appointed by any Judge of the High Court of Justice, or any Judge other than a local Judge. It is agreed that there may be an appeal by either party from any decision or award of such arbitrators to the High Court of Justice for Ontario in accordance with the provisions of the Arbitration Act in that behalf.

22. In case the plant, apparatus, buildings or premises of the Company, or any part thereof, shall at any time during the continuance of this agreement be damaged or destroyed so as to prevent the Company from supplying the said power of the quantity and quality hereinbefore provided for to the Commission the Company shall use its best endeavor to procure the said supply of power for the Commission otherwise or elsewhere and if the Company fails or neglects to procure such power for the Commission then the Commission may with the approval of the Lieutenant-Governor in Council, procure such power at reasonable rates and charge the same to the Company; and if the said power cannot be procured either with the approval of the Lieutenant-Governor in Council terminate this agreement.

23. If at any time that the quantity of power which is being taken under this agreement by the Commission shall amount to sixty per cent. or more of the total power which the Company is developing and a complaint is then made in writing by the Commission to the Company that the Company has so continuously neglected or failed to perform the terms of this agreement that the apparatus of the Commission or its customers cannot by reason of such neglect or failure of the Company be operated to full efficiency and the Company shall not within a reasonable time remedy such neglect or failure, then the matter of complaint may be referred to the Lieutenant-Governor in Council, and if he determine that there is a just ground of complaint he may direct that the Company shall remedy such neglect or failure within a time to be fixed by him, and if such neglect or failure be not remedied as directed by him the Lieutenant-Governor in Council may order that upon such terms as he deem reasonable including the rights of other parties interested, the whole of the plant, apparatus and property of the Company shall be transferred to the Commission, whereupon, on payment and satisfaction of the said terms the amount of which payment and satisfaction is to be settled by the arbitrators appointed as hereinbefore stated, the Commission may, with the approval of the Lieutenant-Governor in Council, take over the plant, apparatus and property and the same shall be transferred to the Commission.

24. The Company agrees with the Commission that the Company will not during the continuance of this agreement exercise the right to cancel the agreement dated 11th April, 1900, between the Company and the Commissioners of the Queen Victoria Niagara Falls Park.

25. In case any municipal corporation which shall contract with the Commission for a supply of power or any person, firm or corporation which shall con-



tract with any such municipal corporation, or with the Commission for a supply of power furnished to the Commission by the Company, shall suffer damages by the act or neglect of the Company, and such municipal corporation, person, firm, or corporation would, if the Company had made this contract directly with them, have had a right to recover such damages or commence any proceedings or any other remedy the Commission shall be entitled to commence any such proceedings or bring such action for or on behalf of such municipal corporation, person, firm or corporation, and notwithstanding any acts, decision or rule of law to the contrary the Commission shall be entitled to all the rights and remedies of such municipal corporation, person, firm or corporation including the right to recover such damages, but no action shall be brought by the Commission until such municipal corporation, person, firm or corporation shall have agreed with the Commission to pay any costs that may be adjudged to be paid if such proceeding or action is unsuccessful. The rights and remedies of any such municipal corporation, person, firm or corporation shall not be hereby prejudiced.

26. Subject to the provisions of paragraphs 22 and 23 of this agreement, notwithstanding there may be differences between the parties hereto as to the supply of sufficiency of the said power or the payment therefor or any other question whatever which may arise under this agreement, the Company shall continue to deliver the power and the Commission to pay therefor and both parties shall continue to carry out the contract notwithstanding such differences; and when the matters which may be so in issue shall be finally determined by the reference to arbitration in the manner provided by paragraph 21 hereof, the parties shall deal with such matters according to the terms of the award which may be made upon such reference. It being the distinct agreement between the parties that there shall not be during the period of this agreement any stoppage or cessation in the supply of the said power or on the payments therefor but that the same shall be continued as if there was no such difference.

27. The Company shall not directly or indirectly deliver power in Ontario to any person or corporation that it is intended shall be supplied by the Commission under this Agreement. In case any difference arises as to the said supply the same shall be settled with the said arbitrators. This paragraph shall not be held to cover or interfere with the supply of power agreed to be delivered by the said Company to any persons or corporations other than the Commission at the date on which the first block of power is ordered by the Commission from the Company under this agreement, but the said supply of power shall continue unaffected by this agreement. The Commission agrees it will not supply power at less than 60,000 volts at a price less than the price herein provided for for power at 60,000 volts with the cost of transforming added thereto to any person or corporation in the territory supplied from the transmission lines of the Company at the rate at which the first block of power is ordered by the Commission from the Company under this agreement. In case any difference arises as to the extent of such territory the same shall be settled by said arbitrators.

28. This agreement shall extend to, be binding upon and enure to the benefit of the successors and assigns of the parties hereto.

29. Notwithstanding anything hereinbefore contained this agreement shall not come into operation as against the Commission or be binding upon the Commission until, in addition to any other orders in council, pursuant to said act, an order in council has been passed and approved by the Lieutenant-Governor in Council expressly declaring that this agreement shall from the date of such order-in-council

be binding upon the Commission, but this shall in no way interfere with the agreement contained in paragraph 2 (e), and the Commission undertakes to do all things lawful in its power that may be needed to bring this agreement into operation at as early a date as possible and to procure the assent and declaration of the said Lieutenant-Governor in Council above referred to and the said Company agrees to co-operate with the Commission by all lawful means in its power to carry out the objects of this agreement.

In witness whereof the said Commission has affixed its corporate seal and has signed, sealed and executed the present agreement; and the Company by and through its President and Secretary duly authorized for all purposes hereof has hereunto affixed its corporate seal under the hands of its President and Secretary.

(Seal.)

A. BECK.  
JOHN S. HENDRIE.  
W. K. McNAUGHT.

THE ONTARIO POWER COMPANY OF NIAGARA FALLS.

J. J. ALBRIGHT, *President*.  
ROBERT C. BOARD, *Secretary*.

(Seal.)

Revised estimates for the Niagara Transmission were again immediately undertaken for the receipt of power of 12,000 volts, transmitting the same at 110,000 volts. The necessary information was obtained by the Engineers with reference to the apparatus for the operation at the higher potential. On May 5th, 1908, your Commissioners instructed the engineering staff to draw up all specifications and plans for the construction of the transmission line for the supply of power to the municipalities who had already contracted for the same.

The following specifications were drawn up, together with the necessary plans:

- (a) Specifications for steel transmission line towers.
- (b) Specifications for transmission line cable.
- (c) Specifications for the erection of high tension transmission lines.
- (d) Specifications for the complete work for the construction of high tension transmission lines.

(e) General conditions of contract accompanying above specifications.

The instruction to bidders and forms of tender are reproduced herewith.

#### INSTRUCTIONS TO BIDDERS ATTACHED TO SPECIFICATIONS FOR STEEL TRANSMISSION TOWERS.

1. Tenders will be received up to noon of Tuesday, June 2nd, 1908, by the Hydro-Electric Power Commission of Ontario for the supply of all materials, the manufacture of same ready for erection, and the delivery thereof as specified below at railroad stations convenient to the route of the transmission lines of about three thousand steel towers of sizes and types as specified.

2. Each tender shall be enclosed in a sealed envelope marked "TENDER FOR STEEL TRANSMISSION TOWERS," and addressed to CHAIRMAN OF HYDRO-ELECTRIC POWER COMMISSION, TORONTO, ONT.

3. The signatures of parties tendering shall be in their respective handwriting.

4. Tenders shall indicate the shortest period of time within which the tenderer will guarantee the delivery of the first hundred towers, after which he shall deliver at the minimum rate of two hundred and fifty per month. Towers shall be delivered in car load lots, F.O.B., sidings as directed (free of duty, if any).

5. Each tender shall be accompanied by a certified cheque for Twenty Thousand (\$20,000) Dollars, which certified cheque shall be forfeited to the Hydro-Electric Power Commission as liquidated damages, in case the tenderer fails to execute the necessary contracts herein referred to, within two weeks after a notification to him from the Commission so to do. Cheques shall be returned to the respective bidders by the Commission upon the awarding and execution of the contracts as aforesaid, and at any rate within sixty days from the date of opening bids.

The successful tenderer will be required to execute a satisfactory bond in the sum of One Hundred Thousand (\$100,000) Dollars for the proper performance of the work embraced in the contract.

The Commission reserves the right to reject any or all tenders. The lowest or any tender will not necessarily be accepted.

The tenders shall state prices per pound for each class of towers and additional material delivered knocked down at above-mentioned points (free of duty, if any).

In addition to the tenderer submitting a proposition exactly upon the design submitted by the Commission he shall submit a tender or tenders upon a design, or designs, offering the same service or what he may consider to be an improvement upon that herein described and indicated on plans, which tender or tenders must be accompanied by complete plans and specifications, and which must conform to all the conditions and requirements herein set out.

The contract shall contain clauses protecting the Commission from monetary loss due to patent litigation, negligence, defective material or workmanship or to the use of unproven apparatus, or to any cause whatsoever.

Dated May 9th, 1908.

#### FORM OF TENDER ATTACHED TO SPECIFICATIONS FOR STEEL TRANSMISSION TOWERS.

....., the undersigned, hereby offer to furnish to the Hydro-Electric Power Commission of Ontario all the necessary materials, labor, machinery and equipment, and to execute and complete in a satisfactory manner all the works required in connection with the manufacture, testing and delivery, F.O.B., cars at points as designated in specifications of the Galvanized Steel Towers and accessories for the Commission's Transmission Lines. 1st. In accordance with the designs of the Commission at a price of ..... per pound, for double circuit towers, and at a price of ..... per pound for single circuit towers. 2nd. In accordance with our design, herewith submitted and marked "Design Accompanying Tender," and with the Hydro-Electric Power Commission's specifications, at a price of ..... cents per pound.

....., further hereby agree to deliver at a price of ..... cents per pound the required parts for tower footings according to drawings and specifications.

....., also hereby agree to design, manufacture and deliver, F.O.B., cars at points on railroads convenient to the transmission line special tower structures as may be specified, at a price of ..... cents per pound.

....., hereby offer and agree to furnish and deliver 100 towers



and accessories within ..... weeks after the execution of the contract.  
 ..... further offer and agree to continuously deliver towers at the  
 rate of not less than two hundred and fifty per month until all are delivered.

....., further hold ..... ready promptly to enter  
 into a contract in form satisfactory to the Commission for the due and proper  
 execution of the work at the above price, and on the terms herein stated, and  
 ..... further agree to furnish security for the due performance of the con-  
 tract in the form of a bond of ..... Dollars (\$ .....), with  
 sureties to the satisfaction of the Commission.

....., herewith enclose an accepted bank cheque payable to the  
 order of the Chairman of the Hydro-Electric Power Commission of Ontario, for  
 the sum of ..... Dollars (\$ ..... ) as required in the "In-  
 structions to Bidders," dated May 9th, 1908.

..... hereby certify that ..... have care-  
 fully investigated all conditions and the items of cost which may or can pos-  
 sibly enter into the cost of the work to .....

Signed .....

Post Office Address,

Dated at .....

..... 1908.

#### INSTRUCTIONS TO BIDDERS ATTACHED TO SPECIFICATIONS FOR TRANSMISSION LINE CABLE.

1. Tenders will be received up to noon of Tuesday, June 2nd, 1908, by the  
 Hydro-Electric Power Commission of Ontario for the supply of all materials,  
 manufacture and delivery thereof, F.O.B. at points designated on railways in  
 different sections, free of all charges, including duty, if any, of approximately  
 Twelve Hundred tons of Copper or Five Hundred and Fifty tons of Aluminum,  
 also for additional cable or wire as specified and under the same conditions if  
 ordered at the date of signing the Contract.

2. Each tender shall be enclosed in a sealed envelope marked "Tender for  
 Transmission Line Cable" and addressed to the Chairman of the Hydro-Electric  
 Power Commission of Ontario, Toronto.

3. The signatures of the parties tendering shall be in their respective hand-  
 writing.

4. The Tenderer shall make himself personally acquainted with the condi-  
 tions affecting the work to be done.

5. The tender shall state the shortest period of time, after execution of con-  
 tract in which the Tenderer will guarantee delivery of the first one hundred  
 thousand (100,000) pounds of cable and shall indicate the number of pounds he  
 will deliver per week thereafter until completion of order; at least 125 tons of  
 copper or its equivalent in aluminum will be required per month.

6. The tender shall be submitted on the accompanying "Form of Tender"  
 and tender offered on other form, or with additions, erasures or alterations, may  
 be rejected as informal.

7. Each tender must be accompanied by a certified cheque for Twenty Thous-  
 and Dollars (\$20,000), which certified cheque shall be forfeited to the Hydro-  
 Electric Power Commission as liquidated damages in case the tenderer fails to

execute the necessary contracts herein referred to within two weeks after a notification to him from the Commission so to do. Cheques shall be returned to the respective unsuccessful bidders by the Commission upon the awarding and execution of the contracts as aforesaid, and at any rate within sixty days from the opening of the bids.

The successful tenderer will be required to execute a satisfactory Bond in the sum of One Hundred Thousand Dollars (\$100,000) for the proper performance of the work embraced in the contract.

8. Tenders shall state prices for copper cable per pound delivered at the sections specified:

- (a) One price for Section A.
- (b) One price for Section B.
- (c) One price for Section C.
- (d) One price for Section D.
- (e) One price for Section E.
- (f) One price for Section F.
- (g) One price for Section G.
- (h) One price for Section H.

9. Prices shall be indicated in words, as well as figures.

10. The Commission reserves the right to reject any and all tenders. The lowest tender will not necessarily be considered the best tender.

11. It is further understood that the tenderer is free to suggest modifications of the details of the cable with corresponding price, although it is necessary for the proper comparison of tenders that the cable be tendered upon as herein specified, suggestions as above being submitted as alternative tenders.

DATED AT TORONTÓ, May 9th, 1908.

FORM OF TENDER ATTACHED TO SPECIFICATIONS FOR TRANSMISSION LINE CABLE.

....., the undersigned, hereby offer to furnish to the Hydro-Electric Power Commission of Ontario all the necessary materials, labor, machinery and equipment, and to execute and complete in a satisfactory manner all the works required in the manufacture, testing and delivery of "TRANSMISSION LINE CABLE," all according to specifications exhibited to ..... and will supply ..... pounds ( ) of Copper Cable with soft Copper core, at a price of ..... cents per pound avoirdupois, or will supply ..... pounds of Aluminum Cable at a price of ..... cents per pound avoirdupois, and will supply ..... pounds ( ) of hard drawn Copper Wire as specified at a price of ..... cents per pound.

....., hereby offer and agree to furnish and deliver one hundred thousand pounds of cable, all in accordance with the specifications and satisfactory to the Engineer within ..... weeks of the execution of the Contract, and deliver ..... pounds per week for succeeding weeks, until the amount contracted for is delivered.

....., further hold ..... ready promptly to enter into a contract in form satisfactory to the Chairman of the Hydro-Electric Power Commission of Ontario, for due and proper execution of the work at the rates and on the terms herein stated; and ..... further agree to furnish security for the due performance of the Contract by a Bond for ..... Dollars ( ) with satisfactory sureties as specified.

....., herewith enclose an accepted bank cheque, payable to the order of the Chairman of the Hydro-Electric Power Commission for the sum of ..... Dollars ( ) as required in the "Instructions to Bidders," dated May 9th, 1908.

....., hereby certify that ..... have carefully investigated all items of cost which do or can possibly enter into the cost of the work to .....

Signed .....

P. O. Address .....

Dated at .....

..... 1908.

#### INSTRUCTIONS TO BIDDERS ATTACHED TO SPECIFICATIONS FOR ERECTION OF HIGH TENSION TRANSMISSION LINES.

1. Tenders will be received up to noon of Tuesday, June the 2nd, 1908, by the Hydro-Electric Power Commission of Ontario for the supply of sundry material and of all labor necessary for and incidental to the Erection of a High Tension Electric Transmission Lines in Ontario, as shown on accompanying plans.

2. Each tender shall be enclosed in a sealed envelope marked "Tender for Erection of High Tension Electric Transmission Lines," and addressed to the Hon. Adam Beck, Chairman of The Hydro-Electric Power Commission of Ontario, Toronto, Ont.

3. The signatures of parties tendering shall be in their respective handwriting.

4. Tenderers shall make themselves personally acquainted with the site of Transmission System, with the nature of the materials to be handled and assembled, and with all conditions affecting the work to be done.

5. Tenders shall be submitted in the accompanying "Form of Tender"; any tenders offered on other forms or with additions, erasures or alterations, may be rejected as informal.

6. Each tender shall be accompanied by the "Instructions to Bidders," "Specifications" and "General Conditions of Contract," along with the plans and drawings as described hereunder, all of which shall form a part of the contract to be entered into by the successful tenderer.

7. The Tender shall state prices as follows:—

(a) A price per footing for the erection of standard steel footings (including excavation, adjusting, levelling and refilling), with the exception of timbering, placing of concrete and rock excavation, which will be considered as extras.



(b) A price per pound of steel for the erection of Double Circuit Standard Towers (including Corner, Anchor and Transposition Towers, which are of approximately the same weight and design), assembly, adjustment, alignment and bolting to footings prepared for them, as specified.

(c) A price per pound of steel for the erection of Single Circuit Standard Towers, under conditions as for Double Circuit Towers above.

(d) Two prices per mile of single conductor for the erection of Aluminum Cable (including the assembling of insulators and their subsequent erection on tower, also the splicing, stringing, adjusting of line conductors, all according to specifications hereto attached), as under:—

(1) A price per mile of Single Conductor erected on Double Circuit Towers.

(2) A price per mile of Single Conductor erected on Single Circuit Towers.

Per mile of Single Conductor will be measured on basis of tower spacing, not with reference to actual length of cable.

(e) Two prices per mile of Single Conductor for the erection of Copper Cable, conditions being similar to those above for Aluminum Cable namely:—

(1) A price per mile of Single Conductor erected on Double Circuit Towers.

(2) A price per mile of Single Conductor erected on Single Circuit Towers.

(f) Two prices per mile of Single Ground Cable, supplied, erected, adjusted and clamped in place on towers:—

(1) A price per mile of Single Conductor erected on Double Circuit Towers.

(2) A price per mile of Single Conductor erected on Single Circuit Towers.

Double Circuit Towers require three Ground Cables, and Single Circuit Towers one Ground Cable, as shown on drawings.

(g) Two prices per mile of line for the erection of Telephone Line, complete, with the exception of telephone instruments:—

(1) A price per mile of line for Two Circuits.

(2) A price per mile of line for Single Circuit.

Prices shall include complete erection and supply of all material not specified as supplied by the Commission.

8. Each tender shall be accompanied by a certified cheque for Four Thousand (\$4,000) Dollars, which certified cheque shall be forfeited to the Hydro-Electric Power Commission as liquidated damages in case the tenderer fails to execute the necessary contracts herein referred to within two weeks after a notification to him from the Commission so to do. Cheques shall be returned to the respective bidders by the Commission upon the awarding and execution of the Contracts as aforesaid, and at any rate within sixty days from the date of the opening of bids.

The successful tenderer will be required to execute a satisfactory bond in the sum of Twenty Thousand (\$20,000) Dollars for the proper performance of the work embraced in the Contract.

The Commission reserves the right to reject any or all tenders. The lowest or any tender will not necessarily be accepted.

The contract shall contain clauses protecting the Commission from monetary loss due to patent litigation, negligence, defective material or workmanship, or to the use of unproven apparatus, or to damage to property or persons, or to any cause whatsoever.

Dated May 9th, 1908.

FORM OF TENDER ATTACHED TO SPECIFICATIONS FOR ERECTION OF HIGH TENSION TRANSMISSION LINES.

....., the undersigned, hereby offer the Hydro-Electric Power Commission of Ontario to furnish all the material, excepting as listed in the specifications under the head "Material Furnished by Commission," all necessary labor, tools, machinery, and other plant, and to execute and complete in a satisfactory and workmanlike manner all the works required in connection with the erection of the Transmission Lines and Telephone Line, all according to the plans and specifications exhibited to..... at the following unit prices:—

For erecting the five sections of Transmission Line as specified under the heading "Scope of Work" in the specifications hereto attached:—

(1) For the erection and adjustment of Standard Steel Footings, complete, including excavation and refilling, per footing.....each.

(2) For the erection of Standard Double Circuit Steel Towers, complete, aligned and bolted to footings, per pound of steel,.....cents per pound.

(3) For the erection of Standard Single Circuit Steel Towers, complete, aligned and bolted to footings, per pound of steel,.....cents per pound.

(4) For the erection of Aluminum Cable, including assembling and mounting of insulators on towers and clamping of same to cable, per mile of Single Conductor (a) for Double Circuit.....per mile (b) for Single Circuit.....per mile.

(5) For the erection of Copper Cable, including assembling and mounting insulators on towers and clamping same to cable, per mile of Single Conductor, (a) for Double Circuit.....per mile, (b) for Single Circuit.....per mile.

(6) For the erection of three galvanized steel ground cables and attaching to Double Circuit Towers, per mile of single cable.....per mile.

(7) For the erection of one Galvanized Steel Ground Cable and attaching to Single Circuit Towers, per mile of Single Cable.....per mile.

.....also agree to erect, on foundations previously prepared, additional Steel Towers designed on lines similar to those of standard type, up to ninety (90) feet in height, and not to exceed six thousand (6,000) pounds in weight, for.....cents per pound.

Also to erect the Telephone Line complete, as per specifications, for..... Dollars per mile of Double Circuit Line complete, and.....Dollars per mile of Single Circuit Line complete.

All on condition that the contract for the whole of the above work be allotted to.....

.....further hold..... ready to enter into a Contract in form satisfactory to the Commission for the due and proper execution of the work at the rates and on the terms herein stated, and .....further agree to furnish security for the due performance of the Contract in a bond for Twenty Thousand Dollars (\$20,000), with satisfactory sureties, as specified.

.....herewith enclose an accepted bank cheque, payable to the order of the Chairman of the Hydro-Electric Power Commission of Ontario, for the sum of Four Thousand Dollars (\$4,000), as required in the "Instructions to Bidders," dated May 9th, 1908.

.....hereby certify that .....  
 have carefully investigated all conditions and the items of cost which may or  
 can possibly enter into the cost of the work to.....

Signed.....

Postoffice Address,  
 .....

Dated.....

# INSTRUCTIONS TO "LUMP SUM" BIDDERS ATTACHED TO TENDER FOR COMPLETE WORK FOR HIGH TENSION TRANSMISSION LINES.

1. Tenders will be received up to noon of Tuesday, June 2nd, 1908, by the Hydro-Electric Power Commission of Ontario, for the supply of all material (excepting insulator parts), do all the work necessary or incidental to the complete installation and placing in satisfactory operating condition, The High Tension Transmission Lines of the Commission, as specified herein:

2. Each tender shall be enclosed in a sealed envelope marked "Tender for COMPLETE WORK FOR HIGH-TENSION TRANSMISSION LINES," and addressed to The Hon. Adam Beck, Chairman of the Hydro-Electric Power Commission of Ontario, Toronto, Can.

3. The signatures of parties tendering shall be in their respective handwriting.

4. Tenderers must make themselves personally acquainted with the site of Transmission Lines, with the nature of the materials to be handled, with the existing conditions in the localities existing and with all items which can enter into the cost of the work to the contractor.

5. Tenders must be accompanied with these "Instructions to Lump Sum Bidders," attached specifications and General Conditions of Contract which will form a part of the Contract to be entered into by the successful tenderer.

6. Each tender shall be accompanied by a certified cheque for Thirty-five Thousand (\$35,000) Dollars, which certified cheque shall be forfeited to the Hydro-Electric Power Commission as liquidated damages, in case the tenderer fails to execute the necessary contracts herein referred to, within two weeks after a notification to him from the Commission so to do. Cheques shall be returned to the respective bidders by the Commission upon the awarding and execution of the contracts as aforesaid, and at any rate within sixty days from the date of the opening of bids.

The successful tenderer will be required to execute a satisfactory bond in the sum of One Hundred and Seventy-five Thousand (\$175,000) Dollars for the proper performance of the work embraced in the contract.

The Commission reserves the right to reject any or all tenders. The lowest or any tender will not necessarily be accepted.

The contract shall contain clauses protecting the Commission from monetary loss due to patent litigation, negligence, defective material or workmanship or to the use of unproven apparatus, or to any cause whatsoever.

Dated May 9th, 1908.



FORM OF TENDER ATTACHED TO SPECIFICATIONS FOR COMPLETE WORK  
FOR HIGH TENSION TRANSMISSION LINES.

....., the undersigned, do hereby offer to the Hydro-Electric Power Commission of Ontario to furnish all the necessary materials, labor, implements, tools, machinery and other plants, and to execute and complete all the works mentioned and described in the accompanying specifications, in a satisfactory and workmanlike manner for the HIGH-TENSION TRANSMISSION LINES, in accordance with plans and specifications, and upon the terms and conditions set out in the form of Contract.

.....hereby, do offer and agree to execute the complete work for the sum of .....

.....Dollars (\$ ), or providing the whole of the work is given to.....

offer and agree to construct Transmission Lines complete, comprising Double Circuit Towers and two three-phase circuits of No. 00 B. and S. Gauge Copper Cable, including Double Circuit Telephone Lines as specified, for the sum of .....

.....Dollars (\$ ) per mile, or with No. 0000 B. and S. Gauge Aluminum Cable for the sum of.....  
.....Dollars (\$ ) per mile.

.....hereby offer and agree to construct Transmission Lines complete, comprising Double Circuit Towers and two three-phase circuits of No. 0 B. and S. Gauge Copper Cable, including Single Circuit Telephone Line as specified, for the sum of.....Dollars (\$ ) per mile, or with No. 000 B. and S. Gauge Aluminum Cable for the sum of .....Dollars (\$ ) per mile.

.....hereby offer and agree to construct Transmission Lines complete, comprising Double Circuit Towers, and one three-phase circuit of No. 0 B. and S. Gauge Copper Cable, including Single Circuit Telephone Line as specified, for the sum of.....Dollars (\$ ) per mile, or with No. 000 B. and S. Gauge Aluminum Cable for the sum of .....Dollars (\$ ) per mile.

.....hereby offer and agree to construct Transmission Lines complete, comprising Single Circuit Towers and one three-phase circuit of No. 0 B. and S. Copper Cable, including Single Circuit Telephone as specified, for the sum of.....Dollars (\$ ) per mile, or with No. 000 B. and S. Gauge Aluminum Cable for the sum of .....Dollars (\$ ) per mile.

.....hold.....ready promptly to enter into a contract in form satisfactory to the Commission for the due and proper execution of the work for the sum and on terms herein stated, and .....further agree to furnish security for the due performance of the Contract in the form of a bond for One Hundred and Seventy-five Thousand Dollars (\$175,000) with sureties to the satisfaction of the Commission.

.....herewith enclose an accepted bank cheque payable to the order of the Chairman of the Hydro-Electric Power Commission of Ontario for the sum of Thirty-five Thousand Dollars (\$35,000) as required in the "Instructions to Lump Sum Bidders," dated May 9th, 1908.

.....hereby offer and agree, should the Contract be let to  
 ....., to complete the work specified and to hand it over to the  
 Commission ready for operation within fifteen months after the date of notification  
 from the Engineer to begin work.

.....hereby certify .....have personally visited and ex-  
 amined the site of Transmission Lines, or have caused it to be visited and ex-  
 amined by a competent person or persons, and have investigated all items of  
 cost which may or can enter into the cost of the work to.....  
 or the amount of Tender submitted.

Signed.....

Post Office Address .....

.....

.....

Dated at.....

.....1908.

The work will include all special structures for river crossings, High Potential  
 Line crossings, Terminals, Anchor Towers, Transposition Towers, etc., necessary  
 for the complete and satisfactory installation of the various lines.

For the above work tenders were called on June 2nd, as per the advertise-  
 ment inserted below, after which the time was extended to July 15th.

#### TENDERS.

##### HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO.

Tenders will be received until Tuesday, 2nd June, 1908, inclusive, for the con-  
 struction of (a) Steel Transmission Towers; (b) Transmission Line Cable; (c) Erection  
 complete of Transmission System; according to plans and specifications to be seen at the  
 Commission's Office, Continental Building, Toronto. Tenders will not be con-  
 sidered unless on forms supplied. An accepted cheque on a chartered bank for five per  
 cent. of the commission's estimate of the cost of the work in each tender, must accom-  
 pany the tender. The cheque will be forfeited if the tenderer declines the contract. The  
 lowest or any tender not necessarily accepted.

Tenders must be sealed and addressed: Hon. Adam Beck, Chairman Hydro-Electric  
 Power Commission, Toronto, Ont.

#### TENDERS.

##### *Extension of Time.*

##### TRANSMISSION LINES—TORONTO-NIAGARA FALLS; ST. THOMAS-NIAGARA FALLS.

Tenders will be received until Wednesday, July 15, 1908, inclusive, for the con-  
 struction of (a) Steel Transmission Towers; (b) Transmission Line Cable; (c) Erection,  
 complete, of Transmission System, according to plans and specifications to be seen at  
 the Commission's office, Continental Life Building, Toronto. Tenders will not be con-  
 sidered unless on form supplied. An accepted cheque on a chartered Bank for 5 per cent.  
 of the Commission's estimate of the cost of the work in each tender must accompany the  
 tender. The cheque will be forfeited if the tenderer declines the contract. The lowest  
 or any tender not necessarily accepted.

Tenders must be sealed and addressed: Hon. Adam Beck, Chairman, Hydro-Electric  
 Power Commission, Toronto, Ont.

On July 15th, twenty-eight tenders were received by your Commissioners,  
 fifteen for the supply of towers, five for the supply of cables, five for the erection  
 of transmission lines and three for the complete work, as follows:

For steel transmission towers, the prices being in cents per pound:—

Canadian Bridge Co., Walkerville.

D.C.....	4.30	Spl.....	4.90
S.C.....	4.30	O.D.....	4.20
Ftgs..	3.80		

Ontario Iron and Steel Co., Toronto.

D.C.....	3.65	Ftgs.....	3.47
S.C.....	3.75	Spl.....	4.25

Ontario Wind Engine & Pump Co.,

D.C.....	4.10	Ftgs.....	4.00
S.C.....	4.20	Spl.....	4.25

John Inglis Co., Toronto.

D.C.....	5.125	Ftgs. ....	5.125
S.C.....	5.125	Spl.....	5.125

International Marine Signal Co., Ottawa.

D.C.....	8.98	Spl.....	9.00
S.C.....	9.1	O.D.....	8.25
Ftgs.....	8.98		

Russel Wheel & Foundry Co., Detroit, Mich.

D.C.....	3.94	Ftgs.....	3.494
S.C.....	4.18	Spl.....	4.4

Goold, Shapley & Muir, Brantford.

D.C.....	3.83	Ftgs.....	3.80
S.C.....	3.85	Spl.....	4.20

Structural Steel Co., Montreal.

D.C.....	4.325	Ftgs.....	4.095
S.C.....	4.325	Spl..	4.325

Collingwood Shipbuilding Co., Collingwood.

D.C.....	4.2	Ftgs.....	4.2
S.C.	4.2	Spl.....	4.2

Parkin Elevator Co., Hespeler.

D.C.....	8.875	Ftgs.....	8.00
S.C.....	8.75	Spl.....	9.00

Canada Foundry Co., Toronto.

D.C.....	5.00	Ftgs.....	5.00
S.C.....	5.00	Spl.....	5.00

Milliken Bros. Receivers of New York.

Alternative design.

D.C.....	3.94	3.84	Spl.....	4.2	4.1
S.C.....	3.94	3.84	O.D.....	3.99	3.89
Ftgs.....	3.94	3.84			

British Insulated & Helsby Cables, Limited, Montreal.

D.C.....	4.7	Ftgs.....	4.7
S.C.....	4.7	Spl.....	4.7

Ritter-Conley Manufacturing Co., Pittsburgh, Pa.

D.C.....	4.30	Spl.....	5.50
S.C.....	4.30	O.D.....	4.10
Ftgs.....	4.00		



Jenckes Machine Co., Sherbrooke, Que.

D.C. ....	3.825	Ftgs. ....	3.825
S.C. ....	3.825	Spl. ....	5.00

The following prices were received for the supply of transmission line cable, the price being in cents per pound:—

Dominion Wire Manufacturing Co., Montreal.

Copper Cable.....	16c.	Hard Copper Wire....	15c.
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Aluminum Corporation, Limited, Toronto.

Aluminum Cable .....	22.9c,
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Eugene F. Phillips Electrical Works, Limited, Montreal.

Copper Cable. ....	14.85	Hard Copper Wire..	14.45c
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Wire and Cable Co., Montreal.

Copper Cable .....	15.65c.	Hard Copper Wire..	15.65c
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British Insulated and Helsby Cables, Limited, Montreal.

Copper Cable .....	18.23c	Aluminum Cable....	28.32
Hard Copper Wire .....	16.56c		

The following prices were received for the erection of transmission line. Numbers are according to clauses in erection specifications:—

Merrill-Ruckgaber-Fraser Co., New York, N.Y.

1 .....	15.00	B .....	65 00
2 .....	1c.	6 .....	106.00
33 .....	1.10c.	7 .....	106.00
4 A .....	\$65.00	Spec.....	1½c.
B .....	65.00	Telephone A.....	400.00
5 A .....	65.00	" B.....	390.00

Muralt & Co., New York, N.Y.

1 .....	8.00	5 A .....	34.00
2 .....	1.2c.	B .....	36.00
3 .....	1.3c.	Spec.....	1.2c.
4 A .....	28.00	Telephone A.....	305.00
B .....	30.00	" B.....	270.00
6 .....	22.00	Erection only. This is irregular.	
7 .....	22.00		

McLennan & Keyes, Toronto.

1 .....	3.91	5 B .....	27.00
2 .....	34c.	6 .....	51.00
3 .....	33c.	7 .....	55.00
4 A .....	\$24.00	Spec.....	1c.
4 B .....	25.00	Telephone A.....	\$246.00
5 A .....	24.00	" B.....	232.00

Campbell, Sinclair & Green, Owen Sound.

1 .....	\$10.00	Spec.....	1½
2 .....	1c.	Telephone A.....	\$260.00
3 .....	½	" B.....	250.00

The following lump sum tenders were received:

F. H. McGuigan Construction Co., Toronto.

A	Aluminum Cable—Milliken Towers or Commission's Substitute.				
B	Copper Cable—				
C	Aluminum Cable—Canadian Bridge Co's Towers.				
D	Copper Cable—				
"A"	\$1,225,000	\$5,100	\$4,690	\$3,940	\$3,430 per mile.
"B"	1,255,000	5,420	4,920	3,940	3,480 "
"C"	1,270,000	5,240	4,830	4,080	3,570 "
"D"	1,300,000	5,560	5,060	4,080	3,620 "

Gas and Electric Power Co., Toronto.

\$1,555,150	\$6,652	\$6,234	\$5,123	\$4,718 per mile.
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After lengthy and careful consideration of these tenders it was decided that tender "C" of the F. H. McGuigan Construction Co. be approved on account of the low price and the immense advantage of the fact of the Commission dealing with one company in the building of the line. Accordingly contract was entered into dated 6th day Nov., 1908, as follows. Agreements of Nov. 25th, 1908, 4th Feb., 1909, are also attached to this contract.

THIS AGREEMENT, dated the 6th day of November, 1908,

BETWEEN THE F. H. MCGUIGAN CONSTRUCTION COMPANY, (herein called the Contractor), the first party, and THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO, (herein called the Commission), the second party.

WITNESSETH, that the parties covenant, promise and agree each with the other as follows:—

1. The General Conditions of Contract, marked A (11 pages), Instructions to lump sum bidders attached to tender for complete work of high tension transmission lines, Specifications for complete work for high tension transmission lines, Form of Tender attached to Specifications for complete work for high tension transmission lines, Specifications for Steel Transmission Towers, Specifications for Transmission Line Cable, Specifications for erection of high tension transmission lines, Data for No. 10 telephone wire and aluminum cable, marked B (31 pages), blue print plan of surveyed transmission lines, blue print transmission lines and stations (No. A 76), blue print all angle iron footing (No. 3 T 26), blue print erection of footing (No. 3 T 29), marked C, blue print single circuit tower, Canadian Bridge Company, marked D, double circuit tower, marked E, blue print required spacing for hanging insulator for aluminum cable (No. 1 T 32), marked F, and all plans, specifications and drawings therein provided for shall form part of this contract.

2. The Contractor agrees:—

- (a) To construct and erect the transmission lines complete, as set forth in said specifications, plans and drawings, and to supply all materials therefor, except high tension insulators.
- (b) To use the best material and perform the said works in a thorough workmanlike manner in strict conformity with the said plans, specifications and drawings.
- (c) Subject to receiving notice in accordance with paragraph 3 (c) hereof, to fully complete and deliver to the Commission on or before the 19th December, 1909, that part of the said works from Niagara Falls

to Dundas, and 120 miles of the said works beyond Dundas, so that the Commission may take power pursuant to its contract with the Ontario Power Company at said date, and deliver the said power at any two of the Cities of Toronto, London and Guelph, and to fully complete and deliver the balance of the said works on or before the 1st July, 1910.

- (d) To execute a bond satisfactory to the Commission in the sum of One Hundred and Seventy-five Thousand Dollars (\$175,000), for the proper performance of the said works, and in respect of the liability under paragraph 4 (a) hereof to furnish a bond satisfactory to the Commission in the sum of \$100,000.
- (e) To obtain the aluminum cable required under this contract from the Northern Aluminum Company of America, to be made at Shawinigan Falls, and the steel towers for aluminum cable from the Canadian Bridge Company at Walkerville <sup>or</sup> <sub>and</sub> the Ontario Iron and Steel Company, of Welland, Ontario. Said steel towers are to be manufactured in Ontario.
- (f) On or before the 4th February, 1909, upon request in writing, to supply to the Commission, within 30 days, from 50 to 125 tons of aluminum cable, as Commission may request, for low tension transmission lines, at the price per pound set forth in the Contractor's letter of 4th August, 1908, to the Commission.
- (g) To permit the Commission on or before the said 4th February, 1909, to withdraw from said tender that part of the transmission line between Berlin and London, via Stratford (about 58 miles). If the said part is withdrawn the Commission may thereafter reduce or increase the mileage of the works five per cent., but if the said part is not withdrawn, the Commission may reduce or increase the mileage of the works ten per cent., and upon any reduction or increase, proper allowances shall be made to the parties respectively, at the rates per mile set forth in the Form of Tender.
- (h) On or before said 4th February, 1909, upon request in writing, to execute a further contract with the Commission to construct not more than 293 miles additional at the same rates, upon the same terms and conditions as are set forth in this contract, except as to time of completion which shall be a reasonable time to be fixed by the Engineer of the Commission.
- (i) The Contractor agrees to alter the design of single circuit and double circuit towers shown in blue prints marked "D" and "E," submitted with his tender of July 15th, 1908, to meet the conditions as to height shown upon the blue print marked "F," and to increase the bolting system of the anchorage. All dimensions of parts and of members to remain as far as practicable as shown on said blue prints. The posts and braces at the ends of cross arms of double circuit tower are to be dispensed with and the ground wire attachment provided for on the ends of said arms. The Contractor shall forthwith erect one single circuit tower and one double circuit tower in accordance with paragraph 9 on page 6 of the Specifications for steel transmission towers hereto attached amended after line II only to read as follows:—



" (1) Two circuit standard towers:

"Test No. 1. At each conductor support, a load of 800 pounds applied in a vertical downward direction; and at each ground cable support, a vertical downward load of 600 pounds.

"Test No. 2. At each of any two conductor supports, a horizontal load of 2,000 pounds parallel to the line and applied simultaneously.

"Test No. 3. At lower cross arm connection, a load of 10,000 pounds in a horizontal direction parallel to line.

" (2) Single circuit standard towers:

"Test No. 1. At each conductor support, a load of 800 pounds applied in a vertical downward direction, and at each ground cable support, a vertical downward load of 600 pounds.

"Test No. 2. At each of any two conductor supports, a horizontal load of 2,000 pounds parallel to the line and applied simultaneously.

"Test No. 3. At the middle cross arm, a load of 7,500 pounds parallel to the line.

"A factor of safety for material of at least  $2\frac{1}{2}$  will be required for above loads."

Should the said towers fail to meet the said tests, the design shall be changed to remedy defects, and the said towers shall be tested, in accordance with the specifications as in this paragraph above set forth, until they are satisfactory to the said engineers. After all necessary changes and new improvements have been made, the Contractor shall make new plans embodying all the changes and improvements made, and these plans, after being approved by the Commission's engineers, shall be accepted as the plans for the said towers under the contract.

(j) If required in writing by the Commission before the 4th day of February, 1909, and after the Commission shall have requested the Contractor to supply the material provided for in paragraph 2 (f) hereof, or to execute the further contract provided for by paragraph 2 (h) hereof, to assign to the Commission the options and agreements now held by the Company from the manufacturers named in paragraph 2 (e) hereof, for the supply of materials required for the purposes set out in said paragraphs to the intent that if the Contractor fails to supply the material and execute the agreement set forth in said paragraphs, the Commission shall have the right to use all options and agreements for their own purposes, and shall not be liable to account in any way to the Contractor for any benefit or advantage that may be derived therefrom. Copies of said options and agreements are to be sealed in an envelope and deposited with The Toronto General Trusts Corporation.

### 3. The Commission agrees:—

- (a) To pay to the Contractor the sum of One Million Two Hundred and Seventy Thousand Dollars (1,270,000), for the said works subject to reduction or increase as aforesaid, upon the terms and conditions set forth in the said General Conditions and Specifications.
- (b) To supply high tension insulators for the said transmission lines free of cost and charge to the Contractor as aforesaid.
- (c) That the Engineer shall, pursuant to paragraph 14 (a) of the General Conditions, give his order to the Contractor as soon as possible, and not later than the 15th November, 1908, to provide material for the said works. Prior to 15th February, 1909, the Commission shall give the Contractor access to at least fifty miles of the right of way, continuous or otherwise, in stretches of not less than five miles, as the said right of way is acquired by the Commission, and as such access is given the Engineer shall give his order to the Contractor to proceed with the works thereon. On the said 15th February, 1909, the Engineer shall, pursuant to said paragraph 14 (a), give his order to proceed with the whole works.

### 4. It is further agreed:—

- (a) If within twelve months from the date of the final certificate of the Engineer, it appears that unsound or defective material supplied by the Contractor has been used, or the said works have not been executed in a substantial, workmanlike and proper manner, the Contractor shall be liable to the Commission for all damages arising therefrom. No certificate, payment, or other act, matter or thing done or omitted under this contract shall bar or prejudice the rights of the Commission.
- (b) If any difference shall arise during the progress or after the completion of the works, as to any matter or thing arising under or out of this contract, such difference shall be referred to two arbitrators, one to be chosen by each of the parties hereto, and they shall choose a third arbitrator, but if they cannot agree such third arbitrator shall be chosen by the Chief Justice at the time of the King's Bench Division of the High Court of Justice. When possible, the arbitrators shall decide such difference in a summary manner. Either party may appeal from any award of the arbitrators, as provided by the Arbitration Act, R. S. O. Chap. 62, but no such appeal shall be carried beyond the decision of the Court of Appeal of Ontario. The arbitrators shall not consider any matter or difference which is expressly or by implication required or permitted to be decided by the Engineer, or as to the grounds upon which, or mode in which, any opinion may have been formed or discretion exercised by the Engineer.
- (c) For all purposes of this contract, notices shall be served upon the Engineer, or his appointee, in writing for the Commission, and upon the Manager, or his appointee, in writing, for the Contractor.
- (d) Time shall be of the essence of this agreement.

- (e) This agreement shall extend to, be binding upon and enure to the benefit of the executors, administrators and assigns of the first party, and of the successors and assigns of the second party.

IN WITNESS WHEREOF the said Commission has affixed its corporate seal and has signed, sealed and executed the present agreement: and F. H. McGuigan, Esquire, has signed, sealed and executed the present agreement on behalf of the said Company.

Witness,

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THIS AGREEMENT, dated the 25th day of November, 1908,

BETWEEN THE F. H. MCGUIGAN CONSTRUCTION COMPANY, the Contractor, the first party, and THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO, the Commission, the second party.

WITNESSETH: 1. In consideration of the sum of One Dollar and the Agreement of 6th November, 1908, between the parties hereto, the first party agrees:—

(a) If inaccurate, to correct the designs “D” and “E” filed with the Commission on 12th November, 1908, pursuant to paragraph 2 (i) of said agreement, so that the said designs shall comply strictly with the said paragraph.

(b) To permit the Commission, within ten days from this date, to submit a design or designs of single circuit and double circuit towers as different from the said designs “D” and “E” as the Commission may desire, and upon receipt of said designs to forthwith erect towers according to each of the said designs so submitted, and to test the said towers in any way the Commission may desire. The Commission may waive the right to require the Contractor to erect a single circuit and double circuit tower under said paragraph 2 (i).

(c) To permit the Commission, within three days of the completion of the said tests, to substitute any modified design, or any other design or designs, provided that the increased cost incidental to the use of a tower erected according to such substituted design shall be borne by the Commission. The Contractor shall be required only to bear a cost equivalent to the cost of erection and test of one single circuit tower and one double circuit tower according to the designs “D” and “E.” The Commission is to bear all cost in addition thereto. When said tests have been completed, the following words of said paragraph 2 (i) shall apply: “After all necessary changes and new improvements have been made, the Contractor shall make new plans embodying all the changes and improvements made, and these plans, after being approved by the Commission’s Engineers, shall be accepted as the plans for the said towers under the contract.”

2. Except as herein expressly provided, nothing in this agreement shall vary or effect the said agreement of 6th November, 1908.



IN WITNESS WHEREOF the said Commission has affixed its corporate seal and has signed, sealed and executed the present agreement; and F. H. McGuigan, Esquire, has signed, sealed and executed the present agreement on behalf of the said Company.

THE F. H. MCGUIGAN CONSTRUCTION COMPANY,  
*Per* F. H. McGuigan.

WITNESS: S.B. VENNING.

As to Signature of Contractor,  
R. B. HALL.

HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO.  
A. BECK,

*Chairman.*

W. K. McNAUGHT.

W. M. WHITEHEAD.

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THIS AGREEMENT dated the Fourth day of February, 1909.

BETWEEN THE F. H. MCGUIGAN CONSTRUCTION COMPANY (herein called the "Contractor"), the first party, and THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO (herein called the "Commission"), the second party.

WHEREAS by an agreement dated 6th November, 1908, between the parties hereto, the Contractor agreed to construct transmission lines for the Commission, and it was provided that the Contractor would supply further material and construct further transmission lines upon the terms set forth in paragraphs 2 (f) and (h) of said agreement.

WITNESSETH that in consideration of the premises and of the sum of One Dollar now paid by the Commission to the Contractor and by him acknowledged, the Contractor agrees with the Commission:

(a) To extend the time within which the Commission may make a request in writing pursuant to the said paragraphs respectively from 4th February, 1909, to 4th May, 1909.

(b) That the said extension of time shall, as far as possible, apply to 2 (j) of the said agreement.

(c) That this agreement shall in no way vary or affect the said agreement except as above specifically provided, and shall not affect the rights, if any, of the Commission as against any sureties for the Contractor.

SIGNED, SEALED AND  
DELIVERED

In the presence of  
D. Z. THOMSON.

F. H. MCGUIGAN CONSTRUCTION COMPANY,  
*Per* F. H. McGuigan.

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Specifications and plans were prepared for the electrical equipment of transformer and interswitching stations during 1908, and on September 28th, 1908, tenders were called for the supply and installation of same, and advertisements were placed in all the leading electrical journals and papers as below:

## TENDERS FOR TRANSFORMER STATION EQUIPMENT.

Tenders will be received until 6 p.m., Monday, 28th September, 1908 (a), for the supply and erection of 63,500 Volt Single Phase or 110,000 Volt Three Phases Transformers for operation on the Commission's 110,000 Volt Transmission System; (b) for the manufacture, supply and erection complete of the Switching and Indicating Apparatus for the 110,000 Volt Transforming Stations. Apparatus is required for the following high tension transformer stations: Niagara Falls Step-up Transformer Station, Toronto, London, Dundas, Guelph, Preston, Berlin, Stratford, St. Mary's, Woodstock, Brantford, and St. Thomas Step-down Transformer Stations; all according to plans and specifications to be obtained at the Commission's Office, Continental Life Building, Toronto. Accepted cheques on chartered banks for amounts specified in "Instructions to Bidders" must accompany each tender for the work. These cheques will be forfeited providing the tenderer declines to enter into a contract after due notice by the Commission.

The lowest or any tender not necessarily accepted.

Tenders must be sealed and addressed:

HON. ADAM BECK,  
Chairman, Hydro-Electric Power Commission, of Ontario.

Toronto, Ontario.

Newspapers inserting this advertisement without authority from the Commission will not be paid for it.

The instructions to bidders and forms of tender for this work follow.

Several tenders were received for this work, and are under consideration.

INSTRUCTIONS TO BIDDERS ATTACHED TO SPECIFICATIONS FOR SWITCHING, CONTROL AND PROTECTIVE APPARATUS, ETC., FOR INTERSWITCHING STEP-UP AND STEP-DOWN TRANSFORMER STATIONS.

1. Tenders will be received up to 6 p.m., September 28th, 1908, by the Hydro-Electric Power Commission of Ontario, for the furnishing, delivery, installing, testing and placing in satisfactory operating condition, the switching, control, protective apparatus and service equipment complete for the interswitching, and transformer stations, according to the attached specifications.

2. Each tender shall be enclosed in a sealed envelope marked "Tender for 110,000 Volt Switching, Control and Protective Apparatus, etc., for Interswitching and Transformer Stations," and addressed to the Hon. Adam Beck, Chairman of the Hydro-Electric Power Commission of Ontario, Toronto, Canada.

3. The signatures of the parties tendering shall be in their respective handwriting.

4. Tenderers shall make themselves personally acquainted with the site of transformer stations, with the nature of the materials to be handled and assembled, and with all the conditions affecting the work to be done.

5. Tenders shall be submitted on the accompanying "Form of Tender," with the tenderer's attached schedule of tests, data, etc. Any tenders offered on other forms, or with erasures or alterations, may be rejected as informal. The tenderer may also attach to the form of tender additional alternative tenders for the works specified.

6. Each tender shall be accompanied by the "Instructions to Bidders," specifications Nos. N-80824, T-80824, L-80824, P-80826, W-80826, D-80827, St.-80827, f-80902, E-80905, O-80908, and G-80816, with the plans and drawings accompanying specifications, and tenderer's attached schedule of tests, data, etc., all of which shall form a part of the contract to be entered into by the successful tenderer.

7. The tenderer shall state prices as follows:

(a) Prices for each interswitching and transformer station complete as specified.

(b) Prices on spare apparatus delivered and erected ready for operation.

8. Each tender shall be accompanied by a certified cheque for Twenty thousand dollars (\$20,000.00), which certified cheque shall be forfeited to the Hydro-Electric Power Commission as liquidated damages, in case the tenderer fails to execute the necessary contracts herein referred to within two weeks after notification to him from the Commission to do so. Cheques shall be returned to the respective bidders by the Commission, upon the awarding and execution of the contracts as aforesaid, and at any rate within sixty days from the date of the opening of bids.

The successful tenderer will be required to execute a satisfactory bond in the sum of One hundred and twenty-five thousand dollars (\$125,000.00) for the proper performance of the work embraced in the contract.

9. The Commission reserves the right to reject any or all tenders. The lowest or any tender will not necessarily be accepted.

10. The contract shall contain clauses protecting the Commission from monetary loss due to patent litigation, negligence, defective material or workmanship, or to the use of improper apparatus, or to damage to property or persons, or to any cause whatsoever to which the contractor is liable.

Dated August 29th, 1908.

HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO.

FORM OF TENDER ATTACHED TO SPECIFICATIONS FOR SWITCHING, CONTROL AND PROTECTIVE APPARATUS, ETC., FOR INTERSWITCHING AND TRANSFORMER STATIONS.

....., the undersigned, hereby offer to furnish to the Hydro-Electric Power Commission of Ontario, all the necessary materials, labor, machinery, equipment, etc., and to execute and complete in a satisfactory manner all the works required in connection with the manufacture, testing, delivery, erection, final test, and placing in satisfactory operating condition in the transformer stations of the Hydro-Electric Power Commission the switching control and protective apparatus, instruments and service equipment complete, all according to specifications and plans submitted to ....., and ..... will supply the apparatus with all accessories complete, installed in the Commission's stations, as below:—

NIAGARA FALLS Step-up Transformer Station, according to Specifications No. N-80814 complete, for the sum of ..... (\$ ) dollars.

TORONTO Step-down Transformer Station, according to Specifications No. T-80824 complete, for the sum of ..... (\$ ) dollars.

LONDON Interswitching and Transformer Station, according to Specifications No. L-80824 complete, for the sum of ..... (\$ ) dollars.

DUNDAS Interswitching and Transformer Station, according to Specifications No. D-80827 complete, for the sum of ..... (\$ ) dollars.

GUELPH Interswitching and Transformer Station, according to Specifications for Guelph No. W 80826 complete, (a) 13,200 volt system, for the sum of ..... (\$ ) dollars; (b) 2,300 volt system, for the sum of ..... (\$ ) dollars.



PRESTON Interswitching and Transformer Station, according to Specifications No. P-80826 complete, for the sum of ..... (\$ ) dollars.

BERLIN Interswitching and Transformer Station, according to Specifications for Berlin No. W-80826 complete, for the sum of ..... (\$ ) dollars.

STRATFORD Interswitching and Transformer Station, according to Specifications for Stratford No. W-80826 complete: (a) 13,200 volt system for the sum of ..... (\$ ) dollars; (b) 2,300 volt system, for the sum of ..... (\$ ) dollars.

ST. MARY'S Interswitching and Transformer Station, according to Specifications for St. Mary's No. W-80826 complete: (a) 13,200 volt system, for the sum of ..... (\$ ) dollars; (b) 2,300 volt system, for the sum of ..... (\$ ) dollars.

BRANTFORD Interswitching and Transformer Station, according to Specifications for Brantford No. W-80826 complete, for the sum of ..... (\$ ) dollars.

WOODSTOCK Interswitching and Transformer Station, according to Specifications for Woodstock No. W-80826 complete, for the sum of ..... (\$ ) dollars.

ST. THOMAS Transformer Station, according to Specifications No. St.-80827 complete: (a) 13,200 volt system, for the sum of ..... (\$ ) dollars; (b) 2,300 volt system, for the sum of ..... (\$ ) dollars.

In case changes are made in any of the above stations necessitating more or less apparatus than called for in the attached specifications, the above lump sum tenders shall be increased or decreased by amounts based upon the following prices:

....., hereby submit the following unit prices for apparatus with accessories furnished and erected complete, according to attached specifications except as noted.

*Niagara Falls Transformer Station.*

One 12,000 volt, 600 ampere automatic, electrically operated, remote control, oil switch, with control and indicating devices and wiring, but without series transformers; Type ..... for the sum of ..... ( ) dollars.

One 12,000 volt, 600 ampere, disconnecting switch, mounted, complete with insulators; Type ..... for the sum of ..... (\$ ) dollars.

One potential transformer on 12,000 volt circuit, for operating a wattmeter or a voltmeter; Type ..... for the sum of ..... (\$ ) dollars.

One series transformer for 600 ampere, 12,000 volt circuit, for operating an oil switch, a wattmeter or an ammeter; Type ..... for the sum of ..... (\$ ) dollars.

One polyphase recording wattmeter, scale 0-12,000 kilowatt, without transformers; Type ..... for the sum of ..... (\$ ) dollars.

One 110,000 volt, 100 ampere automatic, electrically operated, remote control, oil switch, with control and indicating devices; Type .....for the sum of .....(\$ ) dollars.

One 110,000 volt, 150 ampere disconnecting switch; Type .....for the sum of .....(\$ ) dollars.

One set of three, 110,000 volt, series, inverse time limit overload relays for operating an oil switch with wiring; Type ..... for the sum of ..... (\$ ) dollars.

One set of three 110,000 volt, series transformers with an inverse time limit overload relay for operating an oil switch with wiring; Type.....for the sum of ..... (\$ ) dollars.

One 110,000 volt oil insulated choke coil; Type ..... for the sum of ..... (\$ ) dollars.

One set of 110,000 volt electrolytic lightning arresters; Type ..... for the sum of .....(\$ ) dollars.

Six 110,000 volt station busbar insulators with conductor clamps and supports. Type ..... for the sum of ..... (\$ ) dollars each.

One 110,000 volt line outlet; Type ..... for the sum of (\$ ) dollars.

#### *Toronto Transformer Station.*

One 110,000 volt, 100 ampere automatic, electrically operated, remote control, oil switch with control and indicating devices; Type ..... for the sum of .....(\$ ) dollars.

One 110,000 volt, 150 ampere disconnecting switch, mounted complete with insulators; Type ..... for the sum of ..... (\$ ) dollars.

One set of three 110,000 volt, series inverse time limit overload relays for operating an oil switch, with wiring; Type ..... for the sum of .....(\$ ) dollars.

One set of three 110,000 volt series transformers with an inverse time limit overload relay for operating an oil switch, with wiring; Type ..... for the sum of .....(\$ ) dollars.

One 110,000 volt oil insulated choke coil; Type ..... for the sum of .....(\$ ) dollars.

One set of 110,000 volt electrolytic lightning arresters; Type..... for the sum of .....(\$ ) dollars.

Six 110,000 volt station busbar insulators with conductor clamps and supports; Type ..... for the sum of ..... (\$ ) dollars each.

One 110,000 volt line entrance; Type ..... for the sum of .....(\$ ) dollars.

One 13,200 volt, 300 ampere automatic electrically operated, remote control, oil switch with control and indicating devices and wiring, but without series transformers; Type ..... for the sum of ..... (\$ ) dollars.

One 13,200 volt, 300 ampere, disconnecting switch, mounted complete with insulators; Type ..... for the sum of ..... (\$ ) dollars.

One potential transformer on 13,200 volt circuit for operating a wattmeter or a volt meter; Type ..... for the sum of .....  
(\$ ) dollars.

One series transformer for 300 ampere, 13,200 volt circuit for operating an oil switch, a wattmeter, or an ammeter; Type .....  
for the sum of .....(\$ ) dollars.

One 13,200 volt air choke coil complete with insulators and base; Type ....  
.....for the sum of .....  
(\$ ) dollars.

One set 13,200 volt electrolytic lightning arresters; Type.....  
for the sum of .....(\$ ) dollars.

One set of multiple gap arresters and accessories for 13,200 volt line erected complete; Type .....for the sum of .....  
(\$ ) dollars.

One polyphase recording wattmeter, scale 0-5,000 kilowatt without transformers; Type ..... for the sum of .....  
(\$ ) dollars.

#### *London Transformer Station.*

One 110,000 volt, 100 ampere automatic, electrically operated, remote control, oil switch with control and indicating devices; Type.....  
for the sum of .....(\$ ) dollars.

One 110,000 volt, 150 ampere disconnecting switch, mounted complete with insulators; Type .....for the sum of .....  
(\$ ) dollars.

One set of three 110,000 volt, series inverse time limit overload relays for operating an oil switch with wiring; Type .....for the sum of .....  
.....(\$ ) dollars.

One set of three 110,000 volt series transformers with an inverse time limit overload relay for operating an oil switch, with wiring; Type.....  
for the sum of .....(\$ ) dollars.

One 110,000 volt oil insulated choke coil; Type.....for the sum of .....(\$ ) dollars.

One set of 110,000 volt electrolytic lightning arresters; Type.....  
.....for the sum of .....(\$ ) dollars.

Six 110,000 volt station busbar insulators with conductor clamps and supports; Type .....for the sum of .....  
(\$ ) dollars.

One 110,000 volt line entrance; Type.....for the sum of .....  
.....(\$ ) dollars.

One 13,200 volt, 300 ampere automatic electrically operated, remote control, oil switch with control and indicating devices and wiring, but without series transformers; Type .....for the sum of .....  
(\$ ) dollars.

One 13,200 volt, 300 ampere, disconnecting switch, mounted complete with insulators; Type ..... for the sum of .....  
(\$ ) dollars.

One potential transformer on 13,200 volt circuit for operating a wattmeter or a voltmeter; Type ..... for the sum of .....  
(\$ ) dollars.



One series transformer for 300 ampere, 13,200 volt circuit for operating an oil switch, a wattmeter, or an ammeter; Type .....for the sum of ..... (\$ ) dollars.

One 13,200 volt air choke coil, complete with insulators and base; Type .....for the sum of ..... (\$ ) dollars.

One set of 13,200 volt electrolytic lightning arresters; Type..... for the sum of ..... (\$ ) dollars.

One set of multiple gap arresters and accessories for 13,200 volt line erected complete; Type ..... for the sum of ..... (\$ ) dollars.

One polyphase recording wattmeter, scale 0-5,000 kilowatt without transformers; Type ..... for the sum of ..... (\$ ) dollars.

#### *Dundas Station.*

One 110,000 volt, 100 ampere, automatic electrically operated, remote control oil switch with control and indicating devices; Type ..... for the sum of ..... (\$ ) dollars.

One 110,000 volt, 150 ampere ,disconnecting switch, mounted, complete with insulators; Type ..... for the sum of ..... (\$ ) dollars.

One set of three, 110,000 volt series with an inverse time limit overload relays for operating an oil switch, with wiring; Type.....for the sum of ..... (\$ ) dollars.

One set of three, 110,000 volt series transformers with an inverse time limit overload relays for operating oil switch, with wiring; Type..... for the sum of ..... (\$ ) dollars.

One 110,000 volt oil insulated choke coil; Type .....for the sum of ..... (\$ ) dollars.

One set of 110,000 volt electrolytic lightning arresters; Type ..... for the sum of ..... (\$ ) dollars.

Six 110,000 volt station, busbar, insulators with conductor clamps and supports; Type .....for the sum of ..... (\$ ) dollars.

One 110,000 volt line entrance; Type .....for the sum of ..... (\$ ) dollars.

One 13,200 volt, 100 ampere automatic electrically operated, remote control, oil switch with control and indicating devices and wiring, but without series transformers; Type .....for the sum of ..... (\$ ) dollars.

One 13,200 volt, 150 ampere, disconnecting switch, mounted complete with insulators; Type .....for the sum of ..... (\$ ) dollars.

One potential transformer on 13,200 volt circuit for operating a wattmeter or a voltmeter; Type .....for the sum of ..... (\$ ) dollars.

One series transformer for 100 ampere, 13,200 volt circuit for operating an oil switch, a wattmeter or an ammeter; Type .....for the sum of ..... (\$ ) dollars.

One 13,200 volt air choke coil complete with insulators and base; Type .....for the sum of.....(\$ ) dollars.

One set of 13,200 volt electrolytic lightning arresters; Type.....for the sum of.....(\$ ) dollars.

One set of multiple gap arresters and accessories for 13,200 volt line, erected complete; Type .....for the sum of.....(\$ ) dollars.

One Polyphase recording wattmeter, Scale 0-2000 kilowatts without transformers; Type ..... for the sum of.....(\$ ) dollars.

### *Preston Station.*

One 110,000 volt, 100 ampere automatic hand operated, oil break switch, with indicators; Type .....for the sum of.....(\$ ) dollars.

One 110,000 volt, 150 ampere disconnecting switch, mounted complete with insulators; Type .....for the sum of.....(\$ ) dollars.

One set of three, 110,000 volt series inverse time limit overload relays for operating an oil switch, with wiring; Type .....for the sum of..... (\$ ) dollars.

One set of three 110,000 volt series transformers with an inverse time limit overload relay for operating an oil switch, with wiring; Type.....for the sum of..... (\$ ) dollars.

One 110,000 volt oil insulated choke coil; Type ..... for the sum of..... (\$ ) dollars.

One set of 110,000 volt electrolytic lightning arresters; Type ..... for the sum of..... (\$ ) dollars.

Six 100,000 volt station busbar insulators with conductor clamps and supports; Type.....for the sum of .....(\$ ) dollars.

One 110,000 volt line entrance; Type ..... for the sum of.....(\$ ) dollars.

One 6,600 volt, 300 ampere automatic hand operated oil switch, without series transformers; Type ..... for the sum of..... (\$ ) dollars.

One 6,600 volt, 300 ampere disconnecting switch, mounted complete with insulators; Type ..... for the sum of..... (\$ ) dollars.

One potential transformer on 6,600 volt circuit for operating a wattmeter or a voltmeter; Type .....for the sum of ..... (\$ ) dollars.

One series transformer for 300 ampere, 6,600 volt circuit for operating an oil switch, a wattmeter, or an ammeter; Type.....for the sum of ..... (\$ ) dollars.

One 6,600 volt air choke coil complete, with insulators and base; Type.....for the sum of..... (\$ ) dollars.

One set of 6,600 volt electrolytic lightning arresters; Type .....for the sum of..... (\$ ) dollars.

One set of multiple gap arresters and accessories for 6,600 volt lines erected complete; Type.....for the sum of.....  
(\$ ) dollars.

One polyphase recording wattmeter, Scale 0-3000 kilowatts without transformers; Type ..... for the sum of.....  
(\$ ) dollars.

*Woodstock, Berlin, Brantford, Guelph, Stratford, St. Mary's and St. Thomas  
Stations.*

One 110,000 volt, 100 ampere automatic hand operated, oil break switch with indicators; Type..... for the sum of.....  
(\$ ) dollars.

One 110,000 volt, 150 ampere disconnecting switch, mounted complete with insulators; Type .....for the sum of.....  
(\$ ) dollars.

One set of three, 110,000 volt series inverse time limit overload relays for operating an oil switch, with wiring; Type ..... for the sum of.....(\$ ) dollars.

One set of three 110,000 volt series transformers with an inverse time limit overload relay for operating an oil switch, with wiring; Type ..... for the sum of..... (\$ ) dollars.

One 110,000 volt oil insulated choke coil; Type .....  
for the sum of..... (\$ ) dollars.

One set of 110,000 volt electrolytic lightning arresters; Type .....  
for the sum of..... (\$ ) dollars.

Six 110,000 volt station busbar insulators with conductor clamps and supports; Type ..... for the sum of.....  
(\$ ) dollars.

One 110,000 volt line entrance erected complete; Type .....  
for the sum of..... (\$ ) dollars.

One 13,200 volt 100 ampere automatic, hand operated oil switch, without series transformers; Type ..... for the sum of ..... (\$ ) dollars.

One 13,200 volt 100 ampere disconnecting switch, mounted complete with insulators; Type ..... for the sum of.....  
(\$ ) dollars.

One potential transformer on 13,200 volt circuit for operating a wattmeter or a voltmeter; Type ..... for the sum of.....  
(\$ ) dollars.

One series transformer for 100 ampere 13,200 volt circuit for operating an oil switch, a wattmeter or an ammeter; Type .....for the sum of..... (\$ ) dollars.

One 13,200 volt air choke coil, complete, with insulators and base; Type.....  
for the sum of..... (\$ ) dollars.

One set of 13,200 volt electrolytic lightning arresters; Type .....  
for the sum of..... (\$ ) dollars.

One set of multiple gap arresters and accessories for 13,200 volt line erected complete; Type ..... for the sum of.....  
(\$ ) dollars.



*Guelph Station.—2,300 Volt Apparatus.*

One 2,300 volt, 750 ampere 3 P.S.T. automatic, hand operated oil switch without series transformers; Type ..... for the sum of ..... (\$ ) dollars.

One 2,300 volt, 750 ampere, 1 P.S.T. disconnecting switch, mounted complete, with insulators; Type ..... for the sum of..... (\$ ) dollars.

One potential transformer for operating a wattmeter or voltmeter; Type ..... for the sum of..... (\$ ) dollars.

One series transformer for 750 ampere circuit for operating an oil switch, a wattmeter, or an ammeter; Type ..... for the sum of.....

*Stratford, St. Mary's and St. Thomas Stations.—2,300 Volt Apparatus.*

One 2,300 volt, 500 ampere, 3 P.S.T. automatic hand operated oil switch without transformers; Type ..... for the sum of..... (\$ ) dollars.

One 2,300 volt, 500 ampere 1 P.S.T. disconnecting switch, mounted complete with insulators; Type ..... for the sum of..... (\$ ) dollars.

One potential transformer for operating a wattmeter or a voltmeter; Type ..... for the sum of..... (\$ ) dollars.

One series transformer for 500 ampere circuit for operating an oil switch, or a wattmeter or an ammeter; Type ..... for the sum of ..... (\$ ) dollars.

GENERAL.

*Instruments without Transformers.*

- One polyphase recording wattmeter—  
    (a) Scale 0-2000 kilowatts; Type .....for the sum  
        of ..... (\$       ) dollars.  
    (b) Scale 0-3000 kilowatts; Type ..... for the sum  
        of..... (\$       ) dollars.
- One recording power factor meter; Type ..... for the sum  
of ..... (\$       ) dollars.
- One recording voltmeter—  
    (a) Scale 10,000-15,000; Type ..... for the sum  
        of ..... (\$       ) dollars.  
    (b) Scale 1,500-3,000; Type ..... for the sum  
        of ..... (\$       ) dollars.
- One indicating A.C. ammeter—  
    (a) Scale 0-100; Type ..... for the sum  
        of ..... (\$       ) dollars.  
    (b) Scale 0-750; Type ..... for the sum  
        of ..... (\$       ) dollars.
- One indicating A.C. voltmeter, Scale 0-15,000; Type .....  
for the sum of ..... (\$       ) dollars.
- One indicating polyphase wattmeter—  
    (a) Scale 0-2,000 kilowatts; Type ..... for the sum  
        of ..... (\$       ) dollars.  
    (b) Scale 0-3,000 kilowatts; Type ..... for the sum  
        of ..... (\$       ) dollars.

*Service Equipment.*

- One 25 kilowatt single phase transformer, 12,000 volts to 125 volts; Type  
..... for the sum of..... (\$       ) dollars.
- One 15 kilowatt single phase transformer 13,200 volts to 125 volts; Type  
..... for the sum of..... (\$       ) dollars.
- One 5 kilowatt single phase transformer, 13,200 volts to 125 volts; Type  
..... for the sum of..... (\$       ) dollars.
- One 75 kilowatt three phase transformer, 12,000 volts to 125 volts; Type  
..... for the sum of..... (\$       ) dollars.
- One 45 kilowatt three phase transformer, 13,200 volts to 125 volts; Type  
..... for the sum of..... (\$       ) dollars.
- One 15 kilowatt three phase transformer, 13,200 volts to 125 volts; Type  
..... for the sum of..... (\$       ) dollars.
- One 5 kilowatt motor generator set, 125 volts A.C. to 125 volts D.C.; Type  
..... for the sum of..... (\$       ) dollars.

....., hereby submit attached guarantee tests and data  
for the respective apparatus tendered upon.

.....further hold..... ready promptly  
to enter into a contract in form satisfactory to the Commission for the due and  
proper execution of the work for the sums and on terms herein stated, and  
..... further agree to furnish security for the due performance

of the contract in the form of a Bond satisfactory to the Commission, for One Hundred and Twenty-five Thousand Dollars (\$125,000.00) with a Guarantee Company or other sureties as the Commission may determine.

....., herewith enclose an accepted bank cheque payable to the order of the Chairman of the Hydro-Electric Power Commission of Ontario for the sum of Twenty Thousand Dollars (\$20,000.00) as required in the "Instructions to Bidders" attached, dated August 29th, 1908.

.....hereby offer and agree, should the Contract be let to.....to complete the whole of the work specified and to hand it over to the Commission ready for operation within.....months after the date of notification from the Commission to begin work.

....., hereby certify that.....have carefully investigated all conditions and items of cost which may or can possibly enter into the cost of the work to be performed, or the amount of Tender submitted.

Signed .....

Post Office Address .....

Dated at.....1908.

INSTRUCTIONS TO BIDDERS, ATTACHED TO SPECIFICATIONS FOR 63,500 SINGLE PHASE AND 110,000 VOLT THREE-PHASE TRANSFORMERS.

1. Tenders will be received up to 6 p.m., September 28th, 1908, by the Hydro-Electric Power Commission of Ontario, for the manufacture, delivery and complete installation of the following transformers, according to accompanying specifications for single phase and three-phase Transformers.

Erected in Stations at	Number receiv'd.	Capacity K. V. A.	Phase.	Primary voltage.	Secondary voltage
Niagara Falls.....	9	3,000	1	12,000	63,500
Toronto.....	6	1,250	1	63,500	13,200-6,600
London.....	3	1,250	1	63,500	"
Berlin.....	3	500	1	63,500	"
or Berlin.....	1	1,500	3	110,000	"
Brantford.....	3	500	1	63,500	"
or Brantford.....	1	1,500	3	110,000	"
Dundas.....	3	500	1	63,500	"
or Dundas.....	1	1,500	3	110,000	"
Woodstock.....	3	400	1	63,500	"
or Woodstock.....	1	1,200	3	110,000	"
Preston.....	3	750	1	63,500	"
or Preston.....	1	2,250	3	110,000	"
Guelph.....	3	750	1	63,500	"
or Guelph.....	1	2,250	3	110,000	"
Stratford.....	3	500	1	63,500	"
or Stratford.....	1	1,500	3	110,000	"
St. Thomas.....	3	500	1	63,500	"
or St. Thomas.....	1	1,500	3	110,000	"
St. Mary's.....	3	400	1	63,500	"
or St. Mary's.....	1	1,200	3	110,000	"

The above transformers shall be designed for operation at either 13,200 or 6,600 volts by placing low tension windings in series or parallel.



2. Each tender shall be enclosed in a sealed envelope, marked "Tender for 110,000 Volt Transformers," and addressed to the Hon. Adam Beck, Chairman of the Hydro-Electric Power Commission of Ontario, Toronto, Canada.

3. The signatures of the parties tendering shall be in their respective handwriting.

4. Tenderers shall make themselves personally acquainted with the site of transformer stations, with the nature of the materials to be handled and assembled, and with all conditions affecting the work to be done.

5. Tenders shall be submitted in the accompanying "Form of Tender," any Tenders offered on other forms or with additions, erasures or alterations, may be rejected as informal.

6. Each Tender shall be accompanied by the "Instructions to Bidders," "Specifications" and "General Conditions of Contract," along with the plans and drawings as described hereunder, all of which shall form a part of the contract to be entered into by the successful Tenderer.

7. The Tender shall state prices as follows:—

- (a) Prices for Transformers for each station, erected on foundations as specified.
- (b) Alternative prices on Three-Phase Transformers complete.
- (c) A price on spare Transformers, delivered, erected complete in the station specified.

Prices shall include complete erection and supply of all material not specified as supplied by the Commission.

8. Each Tender shall be accompanied by a certified cheque for Fifteen Thousand Dollars (\$15,000.00), which certified cheque shall be forfeited to the Hydro-Electric Power Commission as liquidated damages in case the tenderer fails to execute the necessary contracts herein referred to within two weeks after notification to him from the Commission to do so. Cheques shall be returned to the respective bidders by the Commission upon the awarding and execution of the contracts as aforesaid, at any rate within sixty days from the date of the opening of bids.

The successful tenderer will be required to execute a satisfactory bond in the sum of Sixty Thousand Dollars (\$60,000.00) for the proper performance of the work embraced in the contract.

The Commission reserves the right to reject any or all tenders. The lowest or any tender will not necessarily be accepted.

The contract shall contain clauses protecting the Commission from monetary loss due to patent litigation, negligence, defective material or workmanship, or to the use of unproven apparatus, or to damage to property or persons, or to any cause whatsoever.

Dated August 29th, 1908.

#### FORM OF TENDER ATTACHED TO SPECIFICATIONS FOR 63,000 VOLT SINGLE PHASE AND 110,000 VOLT THREE-PHASE TRANSFORMERS.

....., the undersigned, hereby offer to furnish to the Hydro-Electric Power Commission of Ontario, all the necessary materials, labor, machinery, equipment, etc., and to execute and complete in a satisfactory manner, all the works required in connection with the manufacture, testing, delivery, erection, final test, and placing in satisfactory operation in the transformer stations of the Hydro-Electric Power Commission, all according to the plans and speci-

cations exhibited to..... and will supply them with oil and all accessories complete in the Commission's stations as below for the following prices:—

*At Niagara Falls, Ont.*

Nine (9) single phase, three thousand (3,000) kilo-volt amperes 12,000-63,500 transformers for the sum of ..... (\$ ) dollars.

*At Toronto, Ont.*

Six (6) single phase, twelve hundred and fifty (1,250) kilo-volt amperes 63,500 13,200-6,600 volt transformers for the sum of ..... (\$ ) dollars.

*At London, Ont.*

Three (3) single phase twelve hundred and fifty (1,250) kilo-volt amperes 63,500, 13,200-6,600 volt transformers, for the sum of.....(\$ ) dollars.

*At Berlin, Ont.*

Three (3) single phase five hundred (500) kilo-volt amperes 63,500 13,200-6,600 volt transformers, for the sum of.....(\$ ) dollars, or as an alternative, one three-phase fifteen hundred (1,500) kilo-volt amperes 110,000 13,200-6,600 volt transformers, for the sum of.....(\$ ) dollars.

*At Brantford, Ont.*

Three (3) single phase five hundred (500) kilo-volt ampere 63,500 13,200-6,600 volt transformers, for the sum of .....(\$ ) dollars, or as an alternative, one (1) three-phase fifteen hundred (1,500) kilo-volt ampere 110,000 13,200-6,600 volt transformer, for the sum of.....(\$ ) dollars.

*At Dundas, Ont.*

Three (3) single phase five hundred (500) kilo-volt ampere 63,500 13,200-6,600 volt transformers, for the sum of.....(\$ ) dollars, or as an alternative, one (1) three-phase fifteen hundred (1,500) kilo-volt ampere 110,000 13,200-6,600 volt transformer, for the sum of.....(\$ ) dollars.

*At Woodstock, Ont.*

Three (3) single phase four hundred (400) kilo-volt 63,500 13,200-6,600 volt transformers, for the sum of.....(\$ ) dollars, or as an alternative, one (1) three-phase twelve hundred (1,200) kilo-volt ampere 110,000 13,200-6,600 volt transformer, for the sum of.....(\$ ) dollars.

*At Preston, Ont.*

Three (3) single phase seven hundred and fifty (750) kilo-volt ampere 63,500 13,200-6,600 volt transformers, for the sum of.....(\$ ) dollars, or as an alternative, one (1) three-phase twenty-two hundred and fifty (2,250) kilo-volt ampere 110,000 13,200-6,600 volt transformer, for the sum of..... (\$ ) dollars.

*At Guelph, Ont.*

Three (3) single phase seven hundred and fifty (750) kilo-volt ampere 63,500 13,200-6,600 volt transformers, for the sum of.....(\$ ) dollars, or as an alternative, one (1) three-phase twenty-two hundred and fifty (2,250) kilo-volt ampere 110,000 13,200-6,600 volt transformer, for the sum of.....(\$ ) dollars.

*At Stratford, Ont.*

Three (3) single phase, five hundred (500) kilo-volt ampere 63,500 13,200-6,600 volt transformers, for the sum of.....(\$ ) dollars, or as an alternative, one (1) three-phase fifteen hundred (1,500) kilo-volt ampere 110,000 13,200-6,600 volt transformer, for the sum of .....(\$ ) dollars.

*At St. Thomas, Ont.*

Three (3) single phase five hundred (500) kilo-volt ampere 63,500 13,200-6,600 volt transformers for the sum of.....(\$ ) dollars, or as an alternative, one (1) three-phase fifteen hundred (1,500) kilo-volt ampere 110,000 13,200-6,600 volt transformer, for the sum of.....(\$ ) dollars.

*At St. Mary's, Ont.*

Three (3) single phase four hundred (400) kilo-volt ampere 63,500 13,200-6,600 volt transformers for the sum of.....(\$ ) dollars, or as an alternative, one (1) three-phase twelve hundred (1,200) kilo-volt ampere 110,000 13,200-6,600 volt transformer, for the sum of.....(\$ ) dollars.

Also.....will supply the following spare transformers erected with oil and accessories complete in Dundas, London, Guelph or Stratford stations:

One 1,250 kilo-volt ampere 63,500-13,200 transformer for the sum of.....(\$ ) dollars.

One 750 kilo-volt ampere 63,500-13,200 transformer for the sum of.....(\$ ) dollars

One 500 kilo-volt ampere 63,500-13,200 transformer for the sum of.....(\$ ) dollars

One 400 kilo-volt ampere 63,500-13,200 transformer for the sum of.....(\$ ) dollars

Or the following three-phase 110,000-13,200 volt transformers:

One 2,250 kilo-volt ampere.....(\$ ) dollars

One 1,500 kilo-volt ampere .....(\$ ) dollars.

One 1,200 kilo-volt ampere .....(\$ ) dollars.

One 3,750 kilo-volt ampere .....(\$ ) dollars.

As an alternative for Guelph, Stratford, St. Mary's and St. Thomas.....supply the following 63,500-2,300 volt single phase and 110,000-2,300 volt three-phase transformers for the price stated.



*Guelph.*

Three (3) single phase seven hundred and fifty (750) kilo-volt ampere for the sum of.....(\$ ) dollars, or one three-phase twenty-two hundred and fifty (2,250) kilo-volt ampere for the sum of..... (\$ ) dollars.

*Stratford.*

Three (3) single phase seven hundred (500) kilo-volt ampere for the sum of.....(\$ ) dollars, or one (1) three phase fifteen hundred (1,500) kilo-volt ampere for the sum of.....(\$ ) dollars.

*St. Mary's.*

Three (3) single phase four hundred (400) kilo-volt ampere for the sum of .....(\$ ) dollars, or one (1) three phase twelve hundred (1,200) kilo-volt ampere for the sum of.....(\$ ) dollars.

*St. Thomas.*

Three (3) single phase five hundred (500) kilo-volt ampere for the sum of .....(\$ ) dollars, or one three phase fifteen hundred (1,500) kilo-volt ampere for the sum of.....(\$ ) dollars.

....., hereby offer and agree to deliver all parts of the transformers and all necessary erecting materials within.....months after the letting of the Contract; and.....hereby agree to erect these transformers ready for test in place on foundations within.....weeks after delivery of the materials and plant at the transformer stations and after notification of the Engineer to begin erection.

The following are the estimated weights and quantities of oil required for transformers:

SINGLE PHASE.

K. V. Amp.	400	500	750	1,250	3,000
Weight of Core.					
Weight of Case.					
Weight of Oil.					
Gallons of Oil.					

THREE PHASE.

K. V. Amp.	1,200	1,500	2,250	3,750	9,000
------------	-------	-------	-------	-------	-------

Weight of Core.  
Weight of Case.  
Weight of Oil.  
Gallons of Oil.

The following are the estimated gallons of water required for cooling purposes :

K. V. A. Single Phase.	400	500	750	1,250	3,000
------------------------	-----	-----	-----	-------	-------

Gallons per minute.  
40° C. Full Load.  
24 hour run.

K. V. A. Single Phase.	400	500	750	1,250	3,000
------------------------	-----	-----	-----	-------	-------

Gallons per minute.  
55° C. 1½ Load.  
24 hours run.

K. V. A. Three Phase.	1,200	1,500	2,250	3,750	9,000
-----------------------	-------	-------	-------	-------	-------

Gallons per minute.  
40° C. Full Load.  
24 hour run.  
Gallons per minute.  
55° C. 1½ Load.  
24 hour run.

.....hereby guarantee the following efficiencies at respective loads for single phase 63,500-13,200 volt transformers:—

At 100 per cent. Power Factor.

K. V. A. Capacity.	400	500	750	1,250	3,000
--------------------	-----	-----	-----	-------	-------

Full Load.  
¾ Load.  
½ Load.  
¼ Load.

At 80 per cent. Power Factor.

K. V. A. Capacity.	400	500	750	1,250	3,000
--------------------	-----	-----	-----	-------	-------

Full Load.

$\frac{3}{4}$  Load.

$\frac{1}{2}$  Load

$\frac{1}{4}$  Load.

.....hereby guarantee the following efficiencies at respective loading and power factor for three phase 110,000-13,200 volt transformers.

At 100 per cent. Power Factor.

K. V. A. Capacity.	1,200	1,500	2,250	3,750	9,000
--------------------	-------	-------	-------	-------	-------

Full Load.

$\frac{3}{4}$  Load.

$\frac{1}{2}$  Load.

$\frac{1}{4}$  Load.

At 80 per cent. Power Factor.

K. V. A. Capacity.	1,200	1,500	2,250	3,750	9,000
--------------------	-------	-------	-------	-------	-------

Full Load.

$\frac{3}{4}$  Load.

$\frac{1}{2}$  Load.

$\frac{1}{4}$  Load

.....hereby guarantee the following regulations:—

#### SINGLE PHASE.

K. V. A. Capacity.	400	500	750	1,250	3,000
--------------------	-----	-----	-----	-------	-------

At 100 per cent.  
Power Factor.

At 80 per cent.  
Power Factor.

#### THREE PHASE.

K. V. A. Capacity.	1,200	1,500	2,250	3,750	9,000
--------------------	-------	-------	-------	-------	-------

At 100 per cent.  
Power Factor.



.....hereby submit attached methods of calculating the above efficiencies and regulations, along with characteristic curves and data:

.....further hold.....ready promptly to enter into a Contract in form satisfactory to the Commission for the due and proper execution of the work at the above stated prices, and on terms herein stated, and.....further agree to furnish security for the due performance of the Contract in the form of a bond of Sixty Thousand (60,000) Dollars with sureties to the satisfaction of the Commission.

.....herewith enclose an accepted bank cheque payable to the order of the Chairman of the Hydro-Electric Power Commission of Ontario for the sum of Fifteen Thousand (15,000) Dollars as required in the "Instructions to Bidders," dated August 29th, 1908.

.....hereby certify that.....have carefully investigated all conditions and items of cost which may or can possibly enter into the cost of the work to be performed.

Signed.....

Post Office Address.....

Dated at .....1908.

Specifications and plans were prepared for High Tension Insulators and tenders were called for Dec. 15th, 1908. A copy of the advertisement, which was inserted in all leading journals and papers, is herewith reproduced:

#### HYDRO-ELECTRIC POWER COMMISSION.

##### TENDERS FOR HIGH TENSION INSULATORS

Tenders will be received up to 5 p.m. Tuesday, December 15th, 1908, for the manufacture and delivery of Fifteen Thousand High Tension Insulators for operation on the Commission's 110,000 volt transmission lines, according to the plans and specifications to be obtained at the Commission's Office, Continental Life Building, Toronto.

Contractors are requested to bear in mind that tenders may not be considered unless made upon forms supplied with specifications.

An accepted bank cheque for the sum of seven thousand five hundred dollars (\$7,500) must accompany each tender, which sum will be forfeited, if the party tendering declines entering into a contract for the work, at rates stated in tender.

The lowest or any tender not necessarily accepted.

Tenders must be sealed and addressed: Hon. Adam Beck, Chairman of the Hydro-Electric Power Commission of Ontario, Toronto, Ont.

Tenders were received from several firms in the United States and from one German firm, but owing to the large amount of experimenting and testing necessary to ascertain the relative qualities of the different insulators, the contracts will not be let until 1909.

#### INSTRUCTIONS TO BIDDERS ATTACHED TO SPECIFICATION FOR HIGH TENSION TRANSMISSION LINE INSULATORS.

1. Tenders will be received up till 5 p.m., Tuesday, December 15th, 1908, by the Hydro-Electric Power Commission of Ontario for the supply of all materials, the manufacture and delivery F.O.B. cars at stations along the route of the

transmission line, of "HIGH TENSION TRANSMISSION LINE INSULATORS," as specified.

2. Each tender shall be enclosed in a sealed envelope marked "TENDER FOR HIGH TENSION TRANSMISSION LINE INSULATORS," and addressed to the Hon. Adam Beck, Chairman of the Hydro-Electric Power Commission of Ontario, Toronto, Ontario.

3. The signatures of parties tendering shall be in their respective handwriting.

4. Tenders shall indicate the shortest period of time within which the Tenderer will guarantee the delivery of the first thousand insulators, after which he shall deliver at the minimum rate of twelve hundred (1200 insulators per month. Insulators shall be delivered F.O.B. sidings as directed, with customs duties and all charges paid.

5. Tenders shall be submitted on the accompanying "Form of Tender" with the Tenderer's attached schedule of tests, data, etc. Any tenders offered on other forms, or with erasures or alterations may be rejected as informal.

The Tenderer may also attach and submit additional alternative tenders for the work specified.

6. Tenders shall be accompanied by these "Instructions to Bidders" attached to specifications for "HIGH TENSION TRANSMISSION LINE INSULATORS," "SPECIFICATIONS FOR HIGH TENSION TRANSMISSION LINE INSULATORS," with attached "FORM OF TENDER," and plans and drawings accompanying specifications, along with Tenderer's Schedule of Tests, Data, etc., attached to the Form of Tender, all of which shall form a part of the Contract to be entered into by the successful Tenderer.

7. The Tenderer shall state prices for the insulators, delivered F.O.B. stations, all charges and customs duties paid.

8. Each tender shall be accompanied by a certified cheque for Seven Thousand Five Hundred (\$7,500) dollars, which certified cheque shall be forfeited to the Hydro-Electric Power Commission as liquidated damages, in case the Tenderer fails to execute the necessary contracts herein referred to within two weeks after notification to him from the Commission so to do.

Cheques shall be returned to the respective bidders by the Commission upon the awarding and execution of the contracts as aforesaid, and at any rate within sixty (60) days from the date of the opening of bids.

The successful Tenderer will be required to execute a satisfactory bond in the sum of Thirty-seven Thousand Five Hundred (\$37,500) dollars for the proper performance of the work embraced in the contract.

The Commission reserves the right to reject any or all tenders. The lowest or any tender will not necessarily be accepted.

The Contract shall contain clauses protecting the Commission from monetary loss due to patent litigation, negligence, defective material or workmanship or the use of unproven apparatus.

Dated November 14th, 1908.

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FORM OF TENDER ATTACHED TO SPECIFICATION FOR HIGH TENSION TRANSMISSION LINE INSULATORS.

....., the undersigned, hereby offer and agree to furnish to the Hydro-Electric Power Commission of Ontario, all the necessary material, labor, machinery and equipment for the execution and completion in

a satisfactory manner of all the work required in connection with the manufacture, testing and safe delivery of fifteen thousand (15,000) complete High Tension Insulators, all according to attached specification as follows:—

(a) Thirteen thousand three hundred and fifty (13,350) complete Suspension Insulators for the sum of .....(\$ ) per one hundred (100).

(b) One thousand six hundred and fifty (1,650) complete Strain Insulators for the sum of .....(\$ ) per one hundred (100).

These insulators to be delivered F.O.B. cars at points as designated in the attached specification of High Tension Insulators for the Hydro-Electric Power Commission's Transmission Line.

In addition to the above order ..... further offer and agree to supply, if ordered within six (6) months after awarding of above contract:—

(1) 1,000 Suspension Insulators for the sum of .....(\$ ) per one hundred (100).

(2) 2,000 Suspension Insulators for the sum of ..... (\$ ) per one hundred (100).

(3) 3,000 Suspension Insulators for the sum of ..... (\$ ) per one hundred (100).

(4) 4,000 Suspension Insulators for the sum of ..... (\$ ) per one hundred (100).

(5) 5,000 Suspension Insulators for the sum of ..... (\$ ) per one hundred (100).

(6) 10,000 Suspension Insulators for the sum of ..... (\$ ) per one hundred (100).

(7) 100 Strain Insulators for the sum of .....(\$ ) per one hundred (100).

(8) 200 Strain Insulators for the sum of .....(\$ ) per one hundred (100).

(9) 300 Strain Insulators for the sum of .....(\$ ) per one hundred (100).

(10) 400 Strain Insulators for the sum of .....(\$ ) per one hundred (100).

(11) 500 Strain Insulators for the sum of .....(\$ ) per one hundred (100).

(12) 1,000 Strain Insulators for the sum of .....(\$ ) per one hundred (100).

All the above additional insulators to be delivered F.O.B. cars at Dundas, Ont., all according to attached specification.

....., hereby offer and agree to deliver one thousand (1,000) complete insulators and accessories within ..... weeks after execution of the contract.

....., further offer and agree to continuously deliver complete insulators at the rate of not less than twelve hundred (1200) complete insulators per month until all are delivered.

....., further hold .....ready promptly to enter into a contract in form satisfactory to the Commission for the due and proper execution of the work at the above price, and security for the due performance of the contract in the form of a bond of .....dollars (\$ ) with sureties to the satisfaction of the Commission.



....., herewith enclose an accepted bank cheque payable to the order of the Chairman of the Hydro-Electric Power Commission of Ontario, for the sum of ..... dollars (\$ ..... ) as requested in the "Instructions to Bidders," dated November 14th, 1908.

....., hereby certify that ..... have carefully investigated all conditions and the items of cost which may or can possibly enter into the cost of the work to be .....

Signed .....  
Post Office Address .....  
Dated at .....  
..... 1908.

## MUNICIPAL WORK.

During the year 1906 your Commission were busily engaged preparing several sets of estimates for the various municipalities in the Niagara Power Zone, as to the cost of power and the cost of internal distribution in these municipalities. Engineers were sent throughout the Province to obtain data as to the probable consumption of power throughout the municipalities of Western Ontario, and complete information in this connection was obtained.

A great deal of time was spent also on the question of supplying power for the city of Ottawa. Numerous and lengthy negotiations took place between the Commission and the officials of the city of Ottawa, and the Commission asked for tenders from the Ottawa & Hull Power Manufacturing Co., The Metropolitan Electrical Co. of Ottawa, Hon. Wm. Harty, Kingston, the latter named having rights at Chats Falls. Contract with the Ottawa & Hull Power Manufacturing Co. was prepared, their offer being the most satisfactory, and the Commission prepared a By-law for the city of Ottawa to be voted on the 1st of January, 1907.

During this year several organization meetings of the municipalities throughout Western Ontario were held. The year proved to be of great value in getting the question of Hydro-Electric Power organized and properly understood by the people throughout the Province.

At the beginning of the year 1907 the city of Ottawa submitted a By-law to enter into a contract with the Commission, which was carried by a large majority. After further negotiations this By-law was ratified by the City Council, and the Commission entered into a contract with the Ottawa & Hull Power Manufacturing Co. Copies of the By-law and Contract follow:

## BY-LAW No. 2690.

A By-law to authorize the execution of an agreement with the Hydro-Electric Power Commission of Ontario.

The Municipal Council of the Corporation of the City of Ottawa enacts as follows:—

1. That certain agreement between the Hydro-Electric Power Commission of Ontario and the Corporation of the City of Ottawa, a copy of which is annexed as Schedule "A" to this By-law, and the terms and provisions thereof are hereby approved.

2. His Worship the Mayor of the said City of Ottawa is hereby authorized and instructed to execute the said agreement on behalf of the said Corporation and the Clerk of the said City is hereby authorized and instructed to affix thereto the Corporate Seal of the said City.

Given under the Corporate Seal of the City of Ottawa this 6th day of August, 1907.

Certified.

(Sgd.) JOHN HENDERSON,

City Clerk.

(Sgd.) D'ARCY SCOTT,

Mayor.

## MEMORANDUM OF AGREEMENT, DATED

JULY, 1907.

Between:—

HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO,  
hereinafter called the "Commission," of the first part,

and

MUNICIPAL CORPORATION OF THE CITY OF OTTAWA,  
hereinafter called the "Municipal Corporation,"

of the second part.

WHEREAS, by the Power Commission Act passed by the Legislature of the Province of Ontario in the seventh year of the reign of His Majesty King Edward VII., and chaptered 19, it was, among other things enacted, that any Municipal Corporation might apply to the Commission for the transmission of such electrical power and energy for the uses of the Corporation and the inhabitants thereof, for light, heat and power purposes.

And whereas the Municipal Corporation has applied to the Commission for the transmission to the Corporation of electrical power and energy.

And whereas the Commission has entered into an agreement, a copy of which is hereto annexed, dated \_\_\_\_\_, 1907, with the Ottawa and Hull Power Manufacturing Company, hereafter called the "Company," for the delivery to the Commission of electrical power and energy to be transmitted to the Corporation.

And whereas, under the thirteenth clause of the said annexed agreement "The Commission" agrees that it will enter into an agreement with the Municipal Corporation of the City of Ottawa for the resale of the electrical power hereby contracted for, and such agreement shall contain (inter alia) assignable covenants on the part of the said Corporation.

(a) To pay for electrical power hereby sold at the rate and in the manner herein provided.

(b) That the said Corporation will not, during the currency of this agreement, obtain electric power from any source other than the Commission, or the Company, until the said 2,500 horse power shall have been taken from the Company unless the Company is unwilling to supply to the Commission on the terms set forth in paragraph (1) hereof, such power as the said Corporation may require.

(c) To observe and perform the covenants and conditions herein contained binding upon the Commission, and especially the terms of the seventh paragraph hereof.

Now, therefore, this agreement witnesseth that in consideration of the mutual covenants and agreements herein contained, the Commission for itself, its successors and assigns, and the Municipal Corporation for itself, its successors and assigns, mutually covenant and agree with each other as follows:

(1) The Commission shall deliver to the Municipal Corporation and the Municipal Corporation shall pay for and take from the Commission electrical power for the period, for the prices, upon the terms and conditions, at the times and places and in the quantities as furnished to the Commission in the said annexed agreement with the Company, and the Municipal Corporation shall be liable to the Commission for the receipt and payment for such electrical power, and additional power furnished under said agreement, in the same manner and to the same extent as it would have been if the said agreement between the Commission and the Company had been made directly between the Company and the Municipal Corporation.



(2) The Municipal Corporation covenants and agrees that the power sold under this contract may be used by the Corporation for any purpose whatever within the limits (present or future) of the Municipal Corporation or County of Carleton, but that the electrical power so supplied shall not be resold or used by any Electric Railway Company, or by any other person, or Company operating under a Municipal Franchise for distribution of electricity.

(3) The Municipal Corporation further covenants and agrees that it shall arrange to use all power delivered by the Company under the annexed agreement in a manner that will not cause sudden fluctuations in the demand for power, hunting, pumping or other disturbances, thereby interfering with the Company's system.

In the event of a shut-down of the whole power contracted for by the said annexed agreement occurring from any cause whatsoever the Municipal Corporation shall give the Company due notice by telephone or otherwise of the intention to again start the machinery connected with the power to be supplied by the Commission under this agreement.

The Municipal Corporation shall not allow such machinery to be started before being advised by the Company that everything is in order and everything is ready for its use.

(4) It is understood and agreed that the Commission shall deliver the full amount of power called for under this contract after such quantity is supplied by the Company under the annexed agreement, and the Commission shall only be bound to supply such power as desired from the Company; but the Municipal Corporation shall have no right under this contract to use at any time more power than it may be entitled to use, as set forth in the said annexed agreement, and the Company shall have the right to supply power through or controlled by an automatic switch or circuit-breaker for cutting off the system from the line or lines used to supply power to the Commission when the power taken exceeds the amount to be paid for by more than 10 per cent., the excess of 10 per cent. being allowed for taking care of the instantaneous fluctuations of the system supplied by such power that may occur from some momentary abnormal condition.

The Company shall have the right to install excess or curve-in watt meters for the purpose of determining the amount of excess power, and if the amount so indicated is greater than required for taking care of such occasional instantaneous fluctuations then such excess shall be paid for in blocks of 200 horsepower under the terms and conditions and during the remainder of the life of the said annexed agreement.

In case, however, of short circuit, causing an increase of load to an extent in excess of the quantity of power which the Municipal Corporation is entitled to use, the Municipal Corporation shall not be bound to pay for the same for the remainder of the life of the said annexed agreement, but the Company may cut off the circuit on which such short circuit shall occur and leave it off until the cause of such short circuit has been removed, and the Municipal Corporation shall not be entitled to any rebate for the time for which current shall not be supplied by reason thereof.

If the Municipal Corporation shall at any time make default in payment of any moneys payable under this contract at the times and places named in the said annexed agreement mentioned, and such default shall continue for a period of one month, the Commission may then notify the Municipal Corporation that it intends to cancel and forfeit this contract, and if within one month from the receipt of such notice the moneys which may have accrued due since the date of such default

remain unpaid, the Commission may by notice in writing to the Municipal Corporation cancel and annul this contract, and it shall, from and after the date of delivery of such notice, absolutely cease to be binding upon either party saving any claims or rights of action then already accrued, but the Municipal Corporation shall nevertheless remain liable to the Commission for the damages arising from the determination of this contract. Provided that the option of the Commission to cancel this contract in case of such default as aforesaid on the part of the Municipal Corporation may be exercised, and necessary notices may be given whenever such default as aforesaid shall occur, and the omission to give such notice shall not be deemed to be a waiver of the right of the Commission to give such notices and to cancel this contract in case of such default as aforesaid, upon any subsequent occasion or occasions.

Inasmuch as the Municipal Corporation requires the supply of electrical power continuously and uninterruptedly throughout each and every day of the period of the said annexed agreement, the parties hereto agree that for each and every day and proportionately for any portion of a day thereof, the Company shall fail to deliver power as agreed by reason of negligence on the part of the Company the Commission shall repay to the Municipal Corporation the sum received from the Company under the said annexed agreement, which sum shall be equal to double the proportionate part of the contract price for the time during which such power shall not be delivered, as full liquidated and ascertained damages. In case the supply of power shall be interrupted or fail whether by the act of God, ice, or accident in any way, the Commission shall not be liable for damages for such interruption or failure, or be considered in default provided it use reasonable diligence to restore such supply, but a proportionate abatement shall be made under this contract.

Provided that all due diligence shall be exercised in the removal of the cause preventing delivery of power. In case the Municipal Corporation be rendered unable to receive or utilize to the extent of more than one-half of the average maximum load for the previous 48 hours by reason of the act of God, or (but only on the condition that the main transmission lines from the power house to the sub-station of the City of Ottawa shall be built and thereafter maintained in accordance with the best modern practice in Electrical Engineering) by reason of accident in any way for a longer period than 24 hours, there shall be a proportionate rebate of the price on such amount of power. This rebate, however, in any case shall not be for more than 30 days in any year, and provided always that all due diligence be exercised in the removal of the cause preventing the receiving and utilizing power.

Whenever such suspension occurs and is caused by ice the Municipal Corporation shall request the Company to make every reasonable effort to obtain power from some other water power development for the time of such suspension, and the Corporation agrees to pay the full cost thereof.

This agreement and the covenants and agreements herein contained may be assigned by the Commission to any person, Company or Corporation without the consent, whether verbal or in writing of the Municipal Corporation.

The Municipal Corporation covenants and agrees to observe and perform the covenants and agreements binding upon the Commission contained in the said annexed agreement.

The said Municipal Corporation further covenants and agrees that they will not, during the currency of the said annexed agreement, obtain electrical power from any other source other than the Commission or the said Company until the



said 2,500 horse-power shall be taken from the Company unless the Company is unwilling to supply to the Commission on the terms set forth in the said annexed agreement, such power as the Municipal Corporation may require.

It is understood and agreed between the parties hereto that the Commission shall not be responsible in any manner whatsoever for any damages, injury, loss or accident between the persons or property by the wires, poles, machinery or apparatus placed or constructed, or within the limits of the Municipal Corporation, or by the operation of the work of the same, or by the power transmitted, and if any action is brought against the Commission for any damage, loss, or accident upon the property within the limits of the said City of Ottawa, or any claim is made by the Company to the Commission for such damages under the annexed agreement, the Municipal Corporation shall defend such action at its own cost, and the Municipal Corporation shall be bound to hold the Commission harmless in respect thereof.

It is further understood and agreed that all counterclaims which the Municipal Corporation claim to have against the Commission or the Company shall be notified in writing to the Company during the first 15 days of the month for any claim having arisen during the preceding month. If the said claims should not be allowed by the Company, the same shall be determined by arbitration, as set forth in paragraph 5 of the said annexed agreement.

If default is made at any time in the due performance and observance of the covenants, conditions and provisions herein contained upon the part of the Municipal Corporation, the Commission may forthwith on demand in writing by the Company duly assign to the Company all its right, title and interest in this agreement, and all causes of action which may or shall have arisen in respect thereof.

Signed, Sealed and Delivered in the presence of

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MEMORANDUM OF AGREEMENT made this day of

Between

THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO,  
hereinafter called the Commission of the First Part,

and

THE OTTAWA & HULL POWER & MANUFACTURING COMPANY,  
LIMITED, hereinafter called the Company of the Second Part:

WHEREAS, by the Power Commission Act passed by the Legislature of the Province of Ontario in the seventh year of the reign of His Majesty King Edward VII., and Chaptered—it was, amongst other things, enacted that any Municipal Corporation might apply to the Hydro-Electric Power Commission of Ontario for the transmission to such Corporation of electrical power and energy for the uses of the Corporation and the inhabitants thereof, for lighting, heating and power purposes.

AND WHEREAS, the Municipal Corporation of the City of Ottawa have applied to the Commission for the transmission to the said Corporation of electrical power and energy;

AND WHEREAS, the Company have agreed to supply the Commission with Electrical Power and energy to be transmitted to the said Corporation,

AND WHEREAS, the Lieutenant-Governor of Ontario in Council, upon the recommendation of the Commission, on the \_\_\_\_\_ day of \_\_\_\_\_ duly approved an Order-in-Council authorizing the Commission to enter into this agreement.



NOW, THEREFORE, THIS AGREEMENT WITNESSETH that in consideration of the mutual covenants and agreements herein contained, the Company for itself, its successors and assigns, and the Commission for itself, its successors and assigns, mutually covenant and agree with each other as follows:

(1) The Company shall deliver to the Commission as hereinafter provided, and the Commission shall take from the Company as hereinafter provided, for a period of ten (10) years, commencing on the First day of January, one thousand nine hundred and seven (1907), Electrical Power to the extent of one thousand five hundred (1,500) horse-power.

If, at any time during the currency of this agreement the Commission shall supply or be called upon to supply, directly or indirectly, to the Municipal Corporation of the City of Ottawa, more electrical power than the one thousand five hundred (1,500) horse-power hereby contracted for, it will take and pay for all such additional power, to the extent of one thousand (1,000) horse-power, from the Company in the manner hereinafter provided unless the Company is unwilling to deliver the same, and save as hereinafter provided, it will not obtain the same or any part thereof from any other source.

If and when the Commission requires such additional Electrical Power to be supplied to the Municipal Corporation of the City of Ottawa it shall apply therefor and shall give the Company at least six months' notice in writing, specifying the quantity (in one or more blocks of two hundred (200) horse power), of such power required, and the date when delivery shall be required.

Within ten days after receipt of such application and notice the Company shall notify the Commission whether or not it will supply such additional power or any part thereof (in blocks of two hundred (200) horse power), and the Commission shall be at liberty to obtain from any other person of Company so much of such additional power as the Company may be unwilling to supply without further application to the Company.

The Commission will take and pay for any such additional power to the extent of one thousand (1,000) horse-power (which the Company is willing to supply), during the remainder of the currency of the agreement at the rate and in the manner herein provided. Delivery of such power by the Company to the said Corporation of the City of Ottawa shall be good and sufficient delivery of such power to the Commission for the purposes of this agreement.

(2) The power to be delivered under this agreement shall be delivered at the Ottawa City Limits at the Chaudiere Bridge, but shall be measured by recording instruments supplied by the Company as herein provided in the Company's Power House in Hull, in the Province of Quebec, and no abatement shall be made for any loss of power between the said Power House and the said City Limits.

The representatives of the Commission shall have at all times the right of access to the said instruments and the records of the power measured for the purpose of reading the said instruments or their records.

A horse-power for the purpose of this Agreement is understood to mean seven hundred and forty-six (746) watts when the power factor of the power taken under this contract is above ninety (90) per cent.

If and when the power factor of the power taken under this Contract falls below ninety (90) per cent., then the said power to be paid for under this Agreement shall be computed by this formula: The volts in each phase multiplied by the amperes in each phase respectively and added together, the whole multiplied by nine-tenths (9-10ths) and divided by seven hundred and forty-six (746) equals horse-power to be paid for.

In case of a dispute as to the accuracy of the instruments, a disinterested expert of recognized authority shall be called in to test such instruments, and his decision shall be final, but if the parties fail to agree upon such expert then each party shall name one expert and these two shall name a third, or referee, and the decision of any one of the said experts and of the referee shall be final and binding upon both parties and the expense of such tests shall be borne as the arbitrators shall decide.

(3) Power to be supplied under this Agreement shall be two-phase alternating current having a periodicity of approximately sixty (60) cycles, and a pressure of approximately two thousand three hundred (2,300) volts, varying under normal conditions between two thousand two hundred and fifty (2,250) and two thousand three hundred and fifty (2,350) volts. The Company shall use all due diligence to prevent greater variation than above provided for, caused by temporary abnormal operating conditions, and the Company shall not be in any way liable if such due diligence be used. The Company shall not be responsible for variations in voltage caused by the methods of using the power.

Provided that if required to do so by the Commission, by one year's previous notice in writing, within five years from the first day of January, one thousand nine hundred and seven (1907), the Company will change the said current to three-phase alternating current, having a periodicity of approximately sixty (60) cycles, and a pressure of approximately eleven thousand (11,000) volts. The exact voltage will be specified by the Company when such change is to be made, and the voltage so specified shall not vary under normal conditions more than two and one-half per cent. ( $2\frac{1}{2}$ ) either way at the Company's Power House. The Company shall use all due diligence to prevent greater variation than above provided for caused by temporary abnormal operating conditions, and the Company shall not be in any way liable if such due diligence is used. The Commission agrees that if the change in the voltage above provided is made the transformers for receiving the power at approximately eleven thousand (11,000) volts will be provided, with the necessary taps recommended by the Company. The Company shall not be responsible for variations in voltage caused by the methods of using the power hereby sold.

And provided that if power is required to be divided at approximately eleven thousand (11,000) volts, the Commission will pay the Company an additional amount per annum equal to fifteen per cent. (15%) on the market value of two transformers having sufficient capacity to raise the total amount of power contracted for herein from approximately two thousand three hundred (2,300) volts to approximately eleven thousand (11,000) volts, the value of the transformers to be based on the market price of transformers, equal, in every respect, to those now installed in the Power House of the Ottawa and Hull Power and Manufacturing Company—the market price to be that existing at the time change in voltage is ordered.

The said power shall be supplied continuously for each and every day of the year and for the purpose of this agreement a day shall mean a full day of twenty-four (24) hours.

(4) For the said one thousand five hundred (1,500) horse power so contracted for, the Commission shall pay to the Company the flat rate sum of fifteen dollars (\$15.00) for each horse-power for each year.

And for such additional power applied for by the Commission as herein provided for in blocks of two hundred (200) horse-power, at the same rate (and pro rata for any portion of the year) until the termination of this agreement and un-



der the same conditions as specified for the power herein contracted for, payments for such additional power shall be computed from the day of the first delivery of said additional power. Should power in excess of the quantity herein contracted for be delivered to the City of Ottawa for more than ten (10) minutes consecutively or twenty (20) minutes in the aggregate in any one day, as shown by the measurements herein provided, the Commission will pay for such excess in blocks of two hundred (200) horse-power at the same rate and in the same manner as provided for the power herein contracted for.

(5) The Commission agrees to pay the Company on the 15th day of each month for the power delivered or under contract during the preceding month, and such payments shall be made promptly and when due, without deduction for counter claims or otherwise.

All counter claims which the Commission may have or claim to have against the Company shall be notified in writing to the latter during the first fifteen days of each month for any claim having arisen during the preceding month. If the said claims should not be allowed by the Company the parties hereto agree to submit the same to the arbitration of two arbitrators, one named by either party. If the said arbitrators do not agree they shall appoint a referee, and the decision of any one of the said arbitrators and of the referee shall be final and binding upon both parties hereto. Both parties agree that the proceedings upon such arbitrations shall be conducted with all possible despatch. The expense of such arbitration shall be borne as the arbitrators shall decide.

(6) The Company shall not be responsible in any manner whatsoever for any damage, injury, loss or accident to either persons or property by the wires, poles, machinery or apparatus placed or constructed or being within the limits of the City of Ottawa or by the operation or working of the same or by the power transmitted thereupon, and if any action is brought, or any claim is made against the Company for any damage, loss or accident upon the property within the said City limits, the Commission shall defend the same at its own cost and charge to the complete exoneration of the Company, and shall be bound to hold the latter harmless in respect thereof.

(7) It is understood and agreed that the power sold under this contract may, save as hereinafter provided, be used by the Commission for any purposes whatever within the limits of the Municipal Corporation of the City of Ottawa (present or future) or County of Carleton, but it shall not be resold to or used by any Electric Railway Company or to or by any other Company or person operating under a Municipal franchise for the sale or distribution of electricity.

(8) The Commission shall arrange to use all power delivered by the Company under this contract in a manner that will not cause sudden fluctuations in the demand for power, hunting, pumping, or other disturbances thereby interfering with the Company's system.

In the event of a shut-down of the whole power hereby contracted for occurring from any cause whatsoever, the Commission shall give the Company due notice by telephone or otherwise, of the intention to again start the machinery in connection with the power to be supplied by the Commission. The Commission shall not again allow such machinery to be started before being advised by the Company that everything is in order and everything is ready for its use.

(9) The Company shall deliver the full amount of power called for under this contract, but the Commission has no right under this contract to use at any time more power than it may be entitled to use as herein set forth, and the Company has the right to supply power through or controlled by an automatic switch or



circuit breaker for cutting off the Company's system from the line or lines used to supply power to the Commission, when the power taken exceeds the amount to be paid for by more than ten (10) per cent., the excess of ten (10) per cent. being allowed for taking care of the instantaneous fluctuations of the system supplied by such power that may occur from some momentary abnormal condition.

The Company shall have the right to install excess or curve-drawing watt meters for the purpose of determining the amount of excess power, and if the amount so indicated is greater than required for taking care of such occasional instantaneous fluctuations, then such excess shall be paid for in blocks of 200 horse-power under the terms and conditions and during the remainder of the life of this contract.

In case, however, of short circuits causing an increase of load to an extent in excess of the quantity of power which the Commission is entitled to use, the Commission shall not be bound to pay for same for the remainder of the life of this contract, but the Company may cut off the circuit on which such short circuit shall occur and leave it off until the cause of such short circuit has been removed and the Commission shall not be entitled to any rebate for the time for which current may not be supplied by reason thereof.

(10) If the Commission shall at any time make default in payment of any money payable under this agreement and such default shall continue for a period of one (1) month, the Company may then notify the Commission that it intends to cancel and forfeit this contract, and if within one (1) month from the receipt of such notice the moneys which may have accrued due since the date of such default, the Company may, by notice in writing to the Commission, cancel and annul this contract, and it shall from and after the date of delivery of such notice absolutely cease to be binding upon either party saving any claims or rights of action then already accrued, but the Commission shall nevertheless remain liable to the Company for the damages arising from the determination of this contract. Provided that the option of the Company to cancel this contract in case of such default, as aforesaid on the part of the Commission, may be exercised, and necessary notices may be given whenever such default as aforesaid shall occur, and the omission to give such notice shall not be deemed to be a waiver of the right of the Company to give such notices and to cancel this contract in case of such default as aforesaid upon any subsequent occasion or occasions.

(11) Inasmuch as the Commission requires the supply of electric power continuously and uninterruptedly throughout each and every day of the period of this contract, the parties agree that for each and every day, and proportionately for any portion thereof, on which the Company shall fail to deliver power as agreed by reason of negligence on the part of the Company, the Company shall rebate to the Commission the sum equal to double the proportionate part of the contract price for the time during which such power shall not be delivered, as full, liquidated and ascertained damages. In case the supply of power shall be interrupted or fail, whether from the act of God, ice, or accident in any way, the Power Company shall not be liable for damages in respect to such interruption or failure, nor be considered in default, provided it use reasonable diligence to restore such supply, but a proportionate abatement shall be made in the amount payable under this contract. Provided always that all due diligence shall be exercised in the removal of the cause preventing the delivery of the power. In case the City of Ottawa be rendered unable to receive or utilize to the extent of more than one-half of the average maximum load for the previous forty-eight hours, by reason of the act of God, or (but only on the condition that the main transmission lines from the Power House

to the sub-station of the City of Ottawa shall be built and thereafter maintained in accordance with the best modern practice in Electrical Engineering) by reason of accident of any way, and for a longer period than twenty-four hours, there shall be a proportionate rebate of the price on such amount of power. This rebate, however, in any case, shall not be for more than thirty days in any one year, and provided always that all due diligence be exercised in the removal of the cause preventing the receiving and utilizing power.

Whenever such suspension occurs, and is caused by ice, the Company shall, upon request of the City of Ottawa, make every reasonable effort to obtain power from some other water power development for the time of such suspension, and the Commission agrees to pay the full cost thereof.

(12) This agreement shall not be assigned by the Commission to any person, company or corporation without the consent in writing of the Company, and the Company shall in no case be bound to give such consent.

(13) The Commission agrees that it will enter into an agreement with the Municipal Corporation of the City of Ottawa for the resale of the electrical power hereby contracted for and such agreement shall contain (inter alia) assignable covenants on the part of the said Corporation (1) to pay for electrical power hereby sold at the rate and in the manner herein provided. (2) That the said Corporation will not, during the currency of this agreement, obtain electrical power from any source other than the Commission or the Company until the said 2,500 horse power shall have been taken from the Company, unless the Company is unwilling to supply to the Commission on the terms set forth in paragraph (1) hereof such power as the said Corporation may require. (3) To observe and perform the covenants and conditions herein contained binding upon the Commission and especially the terms of the 7th paragraph hereof.

(14) If default be made at any time in the due performance and observance of the covenants, conditions and provisions herein contained on the part of the Commission, the Commission will forthwith on demand therefor in writing by the Company duly assign to the Company all its right, title and interest in such agreement between the Commission and the said Corporation, and all causes of action which shall have arisen or which may arise in respect thereof.

#### SIGNED, SEALED AND DELIVERED

In the presence of :

The following letter from the Electrical Commission of the City of Ottawa, dated 3rd Sept., 1908, shows results obtained through the efforts of the Commission on their behalf, also report of the Electrical Commission for the same year.

Ottawa, 3rd Sept., 1908.

HON. ADAM BECK, M.L.A.,  
London, Ont.

#### *Re Ottawa's Municipal Electric Light Plant.*

DEAR MR. BECK,—Referring to our conversation with you a few days ago, we now put in writing the information we then gave you.

For several years prior to 1901 the Ottawa Electric Company had a monopoly of the electric business in Ottawa. The rates then charged were:—

15c. net per 1,000 watt hours for light.

\$40.00 and up per horse-power for power.

\$65.00 per arc lamp for lighting the streets.

For three years now the rates have been:

7 1-5c. net per 1,000 watt hours for light.

\$25.00 per horse-power for power.

\$45.00 per arc lamp for lighting the streets.

How this large reduction came about is as follows:—

In 1901 the city gave a franchise to the Consumers' Electric Company, which latter Company went into operation and began to compete with the Ottawa Company in 1903. As the result of this competition, rates were gradually reduced. In 1904 the two Companies got together, and a Bill was introduced in the Dominion Parliament to authorize the Ottawa Company to absorb the Consumers' Company. The Bill was, through the city's opposition, defeated by two votes that year, but in 1905 it was introduced again. It soon became clear that this time it would carry, and it eventually did. When this seemed certain, it was admitted by the promoters that the intention was to raise the rates. It was claimed by the city that this meant about \$150,000 a year more for consumers of electric light and power, to pay.

Before the Bill finally passed, the city exercised a right it had under the franchise given to the Consumers' Company, and bought out the plant of that Company, which was a distributing plant only. The authority for this was contained in a special Act of the City's, passed in 1894 before the Conmee Act.

Immediately upon the city acquiring the distributing plant of the Consumers' Company in 1905, the Ottawa Company took action to prevent its operation by the city, on, amongst other grounds, that the city had no authority to purchase current, as it proposed to do, from a Power Company. The city won in the first Court, but lost by three to two in the Court of Appeal, and the agreement which the city had made with the Power Company was set aside.

We then at once applied to the Hydro-Electric Power Commission for a supply of power, and our application was granted.

After a long negotiation your Commission made an agreement for power with the same Power Company which the city had taken its supply from, and the city made a similar agreement with the Commission. This ended the long litigation and fight between the city and the Ottawa Electric Company.

There were several points on which the Commission secured concessions from the Power Company, and enabled the city to secure power more advantageously than it had previously done.

The principal concession was in the measurement of the power, whereby the city would pay more nearly for the power it actually took. Provision was also made for loss in transmission between the power house and the distributing station. The quantity of power which the city was compelled to take was also made less onerous. There were several other concessions as well.

Since this time everything has run smoothly with the municipal electric plant.

When the city began to do business in 1905 there were:

About 1,200 customers.

The gross revenue was about \$35,000 a year.

The net profit was nil.

About 800 horse power was used.



Now in three years the position is:

About 3,000 customers.

The gross revenue will be over \$100,000 this year.

The net profit will be over \$10,000 after paying interest and sinking fund on the capital invested. This \$10,000 will be placed to depreciation account.

About 2,300 horse power is used, and more will soon be needed.

The city does its own street lighting, charging \$45 per arc lamp, and making a profit of \$5 per lamp on that.

When your Commission made the new contract for power over a year ago about 1,200 horse power was then being used. We pay \$15.00 per horse power under this contract.

There can be no doubt that your Commission saved the situation for Ottawa when you stepped in and made the contract referred to. Without this intervention the city would have been out \$250,000 spent on a distributing plant, the Ottawa Electric Company would have had a monopoly, and the people of Ottawa would have had to pay at least \$100,000 a year more than they are paying now for their electric light.

Ottawa has municipal competition. The city makes fair living rates (which are subject to revision by your Commission), and the Company follows suit. The city cannot make different rates to different persons, but is legally compelled to charge all alike for the same service. Between private companies this is quite different, and frequently one man pays too much and another too little for the same service. We have the same rate for everyone.

There is no indiscriminate rate cutting, charging some people too little one time, and taking it out of them to make up later on.

The city will never give a franchise to any other Electric Company, so that the Ottawa Company will not be compelled to buy off competition at exorbitant prices (afterwards taken out of the customers in increased rates), as they have had to do in the past.

To sum up: Everybody in Ottawa is satisfied, and will do their best to make the present conditions permanent. The people are satisfied because they were saved from a large increase in rates and are ensured reasonable rates. We doubt if anyone in Ottawa desires to change the present conditions.

The only difficulty might be if the City Council at some future time unduly decreased the rates; but this is safeguarded by the provision that these rates are subject to revision by your Commission.

With this safeguard we think we are only expressing the views of the vast majority of the people of Ottawa when we say that the electric situation there is ideal.

You can make whatever use of this letter you see fit.

Yours very truly,

(Signed) J. A. ELLIS,  
City Treasurer and Secretary of Electric  
Commission of Ontario.

(Signed) CHAS. HOPEWELL,  
Controller, Ottawa.  
The Board of Control is the Electric Commission.

## REPORT NO. 1, OF THE MUNICIPAL ELECTRIC COMMISSION.

*To the Council of the Corporation of the City of Ottawa.*

GENTLEMEN,—

1. Your Commission begs to submit herewith the following statements:

- (1) Revenue and expenditure on maintenance account for the year 1908.
- (2) Capital account.
- (3) Installations.
- (4) Summary of business.
- (5) Electric light and power rates in various places.

2. The first Statement shows revenue for 1908 amounting to \$106,800.36, and a gross profit for the year of \$37,122.29. Deducting interest and sinking fund on \$330,000 bonds, leaves a net profit for the year of \$17,722.29, which has been carried to capital account.

3. The Capital Account shows an expenditure for the year of \$26,079.65, which is provided for by the debenture of \$30,000 authorized by the Ontario Railway and Municipal Board. This account has now \$517.80 at its credit.

4. The Installation Statement shows that the customers have increased in 1908 from 2,680 to 3,164, and the number of incandescent lamps installed from 50,715 to 61,040.

5. The summary of Business Statement shows that the percentage of cost of maintenance and operation (exclusive of power) to revenue was decreased last year from 43½ per cent. to 35¾ per cent.

6. The city has now been operating the plant for 3½ years. Comparing the business done by the city in 1908 with the last year of operation by the Consumers' Company, the following results are shown:

(a) The gross revenue was then \$35,207.41. It is now \$106,800.36, an increase of over 200 per cent.

(b) There was then no profit, and not even sufficient receipts to pay interest on the capital invested. There is now a net profit of \$17,722.29, after paying all interest and sinking fund.

(c) The number of customers was then 1,314. There are now 3,164, an increase of about 140 per cent.

(d) The number of incandescent lamps installed was then 28,160. They are now 61,040.

(e) There were then 30 miles of pole lines. There are now 80 miles, of which 40 are for street lighting.

(f) When the plant was purchased there were a large number of streets along which the pole lines had but few customers. These lines, consequently, were not paying. An energetic canvass resulted in changing all this, and now the city has customers along all these streets, and its pole lines are fully loaded with the exception of those in one small district.

(g) Although the capital invested has been increased only about 60 per cent. (from \$200,000 to \$330,000), the revenue derived has been increased over 200 per cent.

(h) Whilst the revenue has increased over 200 per cent., the expenditure for maintenance and operation has increased only about 110 per cent.

(i) The percentage of cost of maintenance and operation (exclusive of power) to revenue was 51 per cent. in the last year of operation by the Consumers' Company. It is now 35¾ per cent.

- (j) Before the Consumers' Company began to do business the rates were:—  
15c. per kilowatt hour for light.  
\$40.00 and upwards per horse power for power.  
\$65.00 per arc lamp for lighting the streets.

They are now:

- 7 1-5c. per kilowatt hour for light.  
\$25.00 per horse power for power.  
\$45.00 per arc lamp for lighting the streets.

7. Full information has been obtained as to the rates charged elsewhere, and this has been tabulated in the statement of rates annexed. The rates charged in most of the cities of Canada, as well as in the larger towns of Ontario, are given. Those for Buffalo are also included, as that city obtains its power from Niagara. The rates in 32 cities and towns are given in the Statement.

It will be seen that Vancouver has the cheapest rate for street lighting, and that Ottawa and Fort William come next.

The rate for arc lamps for commercial use is lower in Ottawa than anywhere else.

This is also the case with regard to incandescent lamps for commercial use.

Niagara Falls has the cheapest meter rate for private lighting, and Fort William and St. Catharines are both a shade below Ottawa. With these exceptions Ottawa is the lowest for private lighting.

Niagara Falls has the cheapest power. Port Arthur and Fort William charge the same as Ottawa. All the other places mentioned in the Statement charge more.

Taken all round, the rates charged by the Ottawa municipal plant for light and power are the lowest of any city in Canada, municipal or otherwise. -

8. When the plant was purchased in July, 1905, it was found that most of its customers, including all householders, paid the same meter rate. The other customers, consisting of storekeepers, got flat rates.

The following extract from a report of the Electric Commission to Council on 1st June, 1906, which was adopted by Council, explains just what the situation was then, and what was done to remedy it:—

“When the Consumers' Company was operating the plant there was no tariff of charges for flat rates for stores, etc. The result was that different prices were charged for the same services. Whilst the (then) Mayor was in charge of the plant, and before your Commission was appointed, he, on the advice of the Electrical Superintendent, prepared a tariff to apply to all flat rates. This tariff has been in force ever since, the result being that any business taken now is all on the same terms, namely, there is exactly the same price to everyone for the same service. Some of this old flat rate business was done at a loss, whilst in other cases the charges were higher than they should have been. The tariff above mentioned equalizes all this.”

Ever since the purchase of the plant the tariff referred to has never in any case been departed from.

The rates charged are subject to the approval of the Hydro-Electric Power Commission, from whom the city purchases its power, and they cannot be changed without the approval of that Commission.



9. Your Commission will continue the policy of extending the pole lines wherever there is sufficient business to warrant it.

Respectfully submitted,

CHAS. HOPEWELL, *Chairman.*

JAS. DAVIDSON.

ROBT. HASTEY.

G. H. WILSON.

NAPOLEON CHAMPAGNE.

Ottawa, 3rd February, 1909.

# APPENDIX I.

## STATEMENT OF REVENUE AND DISBURSEMENTS ON MAINTENANCE ACCOUNT OF THE MUNICIPAL ELECTRIC DEPARTMENT, FOR THE YEAR ENDING 31ST DECEMBER, 1908.

### Revenue.

#### Gross receipts from all sources:—

Lighting, heating, power, sale of incandescent lamps, etc., paid to City Treasurer .....	\$104,639 04	
Less Cash on hand, December 31st, 1907 .....	2,153 82	
		\$102,485 22
Accounts rendered, but not yet paid .....	15,309 77	
Value of same on 31st December, as per last statement....	12,370 58	
		2,939 19
Amount of money earned for which accounts are not yet rendered .....	3,000 00	
Less value of same included in last statement .....	7,000 00	
Cash on hand— 31st December, 31st, 1908 .....		725 95
Incandescent lamps, arc lamps, globes, and carbons— In stock on 31st December, 1908 .....	2,269 36	
Value of same on hand, 31st December, 1907, as per last statement .....	2,367 59	
Proportion of office rent— Paid by the Ottawa and Hull Power and Manfg. Co. ....		650 00
Total .....		\$106,800 36

### Disbursements.

Power .....	\$31,500 00	
Less amount included in last statement and then unpaid..	2,625 00	
		28,875 00
Wages and salaries .....	20,860 82	
Less amount included in last statement and then unpaid..	402 86	
		20,457 96
Office rent .....	1,792 23	
Less amount included in last statement and then unpaid..	180 00	
		1,612 23
Accident insurance, etc .....		145 00
Legal expenses, etc. ....		361 51
Meter inspection .....		703 90
Arc lamp, globes and carbons .....	2,010 11	
Less amount included in last statement and then unpaid ..	372 15	
		1,637 96
Incandescent lamps .....	4,356 25	
Less amount included in last statement and then unpaid...	80 18	
		4,276 07
Damages, costs, etc., <i>re</i> Estate Jas. Mills .....		2,550 00
Office and other expenses .....	2,259 63	
Less amount included in last statement and then unpaid..	829 27	
		1,430 36

## Accounts outstanding—

Power .....	\$2,875 00
Office rent .....	180 00
Arc lamp globes and carbons .....	46 20
Meter inspection .....	21 25
Incandescent lamps .....	276 55
Sundry expenses .....	130 80

3,529 80

## Difference—

Between value of amounts of money earned for accounts not yet rendered on December 31st, 1907, and December 31st, 1908, as per opposite page .....	4,000 00
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## Difference—

Between value of incandescent lamps, arc lamp globes and carbons on hand, 31st December, 1907, and December 31st, 1908, as per opposite page .....	98 23
--	-------

Showing gross profit of \$37,122.24.

Interest and sinking fund ..... 19,400 00

## Net profit—

(After paying interest and sinking fund) transferred to capital account for depreciation .....	17,722 24
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Total ..... \$106,800 36

## APPENDIX 2.

## CAPITAL ACCOUNT UP TO 31ST DECEMBER, 1908.

## Assets.

Value of plant purchased from the Consumers' Electric Company ..... \$200,000 00

## Expenditure on construction account—

From 17th July, 1905, to 31st May, 1906 .....	17,738 50
“ 1st June, 1906, to 30th November, 1906 .....	17,986 74
“ 1st December, 1906, to 31st May, 1907 .....	13,823 25
“ 1st June, 1907, to 31st December, 1907 .....	76,364 82

## For year ending 31st December, 1908—

Pole lines .....	\$12,118 23
Transformers .....	4,076 12
Meters .....	5,830 08
Arc lamps and apparatus .....	1,750 66
Station buildings and equipment .....	1,030 38
Sundry supplies .....	1,274 18

26,079 65

## Less—

Stock of poles, transformers, meters, arc lamps, apparatus, etc., on hand, 31st December, 1908 .....	5,422 12
---	----------

Expenditures in extension to plant for year ending 31st December, 1908 .....	20,657 53
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\$346,570 84

## Deducted from value of plant for depreciation—

Balance of profit brought forward from profit and loss account on 31st May, 1907 .....	\$4,703 27
Balance of profit brought forward from maintenance account on 31st December, 1907 .....	85 20
Balance of profit brought forward from maintenance account on 31st December, 1908 .....	17,722 29

22,510 76

Value of plant on 31st December, 1908 ..... 324,060 08

Poles, wire, transformers, meters, arc lamps and apparatus,  
etc., in stock on 31st December, 1908 ..... 5,422 12

Balance at credit ..... 517 80

Total ..... \$330,000 00

Liabilities.

Debentures issued—		
To pay Consumers' Electric Company for plant .....		\$200,000 00
For extensions to plant in 1906 .....		50,000 00
For street lighting in 1907 .....		50,000 00
For extensions in 1908 .....		30,000 00
Total .....		\$330,000 00

APPENDIX 3—STATEMENT OF INSTALLATIONS.

	7th July, 1905.	31st May, 1906.	31st May, 1907.	31st Dec., 1907.	31st Dec., 1908.
Incandescent Lamps .....	28,160	34,904	46,730	50,715	61,040
Arc Lamps .....	175	177	249	817	841
Motors .....	64	81	86	88	98
Customers.....	1,314	1,840	2,395	2,680	3,164

APPENDIX 4—SUMMARY OF BUSINESS.

Period.	Revenue.	Expenditure.			Profit.	Percentage of Maintenance and Operation, exclusive of Power, to Revenue.
		Power.	Maintenance and Operation.	On account Interest.		
Consumers Co.:	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	
Year ending 30th April, 1904 .....	24,383 68	6,036 66	18,011 20	335 82	.....	74
Year ending 30th April, 1905 .....	35,207 41	10,125 00	17,988 07	7,094 34	.....	51
Municipal:				Interest and Sink- ing Fund.		
10½ months, from 17th July, 1905, to 31st May, 1906.....	47,313 59	16,875 00	18,869 05	11,257 54	312 00	40
Year, from 1st June, 1906, to 31st May, 1907 .....	67,993 81	22,500 00	27,377 54	13,725 00	4,391 27	40
7 months, from 1st June, 1907, to 31st Decem- ber, 1907 .....	40,556 51	13,875 00	17,700 50	8,895 81	85 20	43
Year, ending 31st De- cember, 1908 .....	106,800 36	31,500 00	38,178 07	19,400 00	17,722 29	35



APPENDIX 5.  
STATEMENT AS TO ELECTRIC LIGHT AND POWER RATES IN VARIOUS PLACES.

	Street Lights, per Arc Lamp.	Power, per Horse Power.	Arc Lamps, for Commercial use.	Meter Rate, for Private Light- ing, per K.W. hour net.	Meter Rate, for Commercial K.W. hour net.	Flat rate, for Commercial Lighting, per 16 Candle Power Lamp.
Brantford .....	\$55 00	\$30 to \$63	.....	8 $\frac{1}{2}$ c.	8 $\frac{1}{2}$ c.	.....
Brockville .....	62 50	.....	\$105.00	10	10	\$9 down
Buffalo, N.Y. ....	75 00	\$28 to \$53	.....	10	*4 to 12	.....
Calgary .....	156 00	*4 $\frac{9}{16}$ to 5 $\frac{9}{16}$ c. per K.W. hour	.....	10 $\frac{1}{2}$	7 $\frac{3}{4}$ to 10 $\frac{1}{4}$	\$9.00
Cornwall .....	82 12	\$20 to \$30	\$73.00	13 $\frac{1}{2}$	13 $\frac{1}{2}$	\$5.40
Edmonton .....	*5c.	*3 $\frac{1}{2}$ c. to 8c. per K.W. hour	*7 $\frac{1}{2}$ c. per K.W. hour	7 $\frac{1}{2}$	7 $\frac{1}{2}$	.....
Frederickton, N.B. ....	.....	.....	.....	12	12	.....
Fort William .....	45 00	\$25 00	*6 $\frac{3}{4}$ c. per K.W. hour	6 $\frac{3}{4}$	6 $\frac{3}{4}$	.....
Galt .....	75 00	.....	\$52.00	12	.....	.....
Guelph .....	60 00	*3c. to 5c. per K.W. hour	\$73.00	10	10	.....
Halifax .....	65 00	*11 $\frac{1}{2}$ c. per K.W. hour	.....	15 with 10 p.c. to 25 p.c. dis.	15 with 10 p.c. to 25 p.c. dis.	.....
Hamilton .....	47 50	*1c. to 3c. per K.W. hour A.C. \$40 to \$80 D.C.	*4 $\frac{5}{16}$ c. per K.W. hour and \$12.00	*5 $\frac{9}{16}$ to 7 $\frac{1}{16}$ c.	.....	\$1.20 and *4 $\frac{5}{16}$ per K.W. hour
Kingston .....	60 00	*5c. to 10c. per K.W. hour	.....	10	10	.....
London, Ont. ....	83 95	\$30 to \$70 A.C. \$95 to \$120 D.C.	.....	7 $\frac{1}{2}$ to 13 $\frac{1}{2}$	7 $\frac{1}{2}$ to 13 $\frac{1}{2}$	.....
Montreal .....	60 00	\$20 00	.....	4 $\frac{1}{2}$	7 $\frac{1}{2}$ to 10	\$2.64
Niagara Falls, Ont. ....	85 00	\$17.50 limited	\$30 limited	7 $\frac{1}{2}$ to 10	7 $\frac{1}{2}$ to 10	\$2.52
Owen Sound .....	51 00	\$25.00 A.C.	\$36 unlimited	8 to 12	.....	.....
Ottawa .....	45 00	\$30.00 D.C.	.....	.....	.....	.....
Pembroke .....	55 00	.....	.....	.....	.....	\$3.60 to \$6.00

APPENDIX 5—Concluded.  
STATEMENT AS TO ELECTRIC LIGHT AND POWER RATES IN VARIOUS PLACES.—Concluded.

		Street Lights, per Arc Lamp.	Power, per Horse Power.	Arc Lamps, for Commercial use.	Meter Rate, for Private Light- ing, per K.W. hour net.	Meter Rate, for Commercial Lighting, per K.W. hour net.	Flat Rate for Commercial 16 Candle Power Lamp.
Peterborough .....	Company .....	\$50 00	\$20 to \$40	*10c. per K.W. hour	7½ c.	10 c.	\$3.00
Port Arthur .....	Municipal .....	48 00	\$25.00	\$45.00	6 to 10 with discount	.....	\$2.88
Quebec .....	Company .....	62 10	.....	.....	12	12	.....
Regina .....	Municipal .....	87 50	*5c. to 10c. per K.W. hour.	*10c. per K.W. hour	9	8	.....
St. John, N.B. ....	Company .....	75 00	\$24 to \$60	*9½c. per K.W. hour	10 to 13½	10 to 13½	.....
Sherbrooke .....	Municipal .....	60 00	*7c. per K.W. hour	\$91 25	9½	.....	\$5.70
St. Thomas .....	" .....	91 25	\$30 to \$90	*12c. per K.W. hour	10	10	.....
St. Catharines .....	Company .....	50 00	.....	\$35.04	7	7	.....
Toronto .....	" .....	69 35	.....	*12c. per K.W. hour	8	12	.....
Windsor .....	Municipal .....	.....	*2c. to 7c. per K.W. hour	\$72.00	8 to 12	.....	.....
Victoria, B.C. ....	Company .....	.....	*2c. to 7c. per K.W. hour	.....	.....	.....	.....
Vancouver .....	" .....	38 00	*2c. to 7c. per K.W. hour	*\$3.00 and 3c. to 10c. per K.W. hour	*3 to 10	*3 to 10	.....
Winnipeg .....	" .....	61 12	*2½c. to 5½c.	*9c. per K.W. hour	9	9	.....

Where there are blanks, prices are not obtainable, or services not given.

\*Rates marked thus, reduced to same basis as Ottawa Municipal rates, are greater than the latter.  
1 cent per K.W. hour for power = \$23.00 per horse power. 1 cent per K.W. hour for Arc lamps = \$15.00 per lamp.

The year 1908 was an extremely busy one, and of great utility to the Province. In January of this year, thirteen municipalities submitted to the people by-laws to raise sums of money to cover the cost of distribution of power to be purchased from the Hydro-Electric Power Commission. In spite of tremendous, and in a great many cases unfair, opposition the by-laws were carried by large majorities in the municipalities of Toronto, Hamilton, London, St. Thomas, Brantford, Galt, Stratford, Woodstock, Guelph, Waterloo, St. Mary's, Hespeler, and New Hamburg. Ingersoll defeated the by-law to purchase a local system as the electors considered that the price asked was too high, but they have since entered into a contract with the Commission for a supply of power, together with the following towns and cities:—

Toronto .....	10,000 H.P.
London .....	5,000 "
Guelph .....	2,500 "
St. Thomas .....	1,500 "
Woodstock .....	1,200 "
Ingersoll .....	500 "
Berlin .....	1,000 "
Hespeler .....	400 "
St. Mary's .....	500 "
Preston .....	600 "
Waterloo .....	685 "
New Hamburg .....	250 "
Stratford .....	1,000 "

The following is copy of Agreement entered into between the Commission and municipalities:—

This Indenture made the 4th day of May, 1908. Between the Hydro-Electric Power Commission of Ontario, acting herein on its own behalf and with the approval of the Lieutenant-Governor-in-Council, (hereinafter called the Commission), party of the First Part, and The Municipal Corporations of Toronto, London, Guelph, Stratford, St. Thomas, Woodstock, Berlin, Galt, Hespeler, St. Mary's, Preston, Waterloo, New Hamburg, and Ingersoll, (hereinafter called the Corporations), parties of the Second Part.

Whereas pursuant to "An Act to provide for transmission of electrical power to municipalities," the Corporations applied to the Commission to transmit and supply such power from Niagara Falls, and the Commission entered into contracts, hereto attached, with the Ontario Power Company of Niagara Falls, (hereinafter called the Company), for such power at the prices set forth in the schedule, hereto attached, and the Commission furnished the Corporations with estimates, as shown in the schedules of the total cost of such power, ready for distribution within the limits of the Corporations, and the electors of the Corporations assented to By-laws authorizing the Corporations to enter into a contract with the Commission for such power, and the Commission have estimated the line loss and the cost to construct, operate, maintain, repair, renew and insure a line to transmit, nominally, 30,000 horse power with total capacity of 60,000 horse power of such power to the Corporations, and have apportioned the part of such cost to be paid by each Corporation as shown in said schedule;

Now therefore this Indenture witnesseth that in consideration of the premises and of the agreements of the Corporations herein set forth, subject to the provisions of said Act and of the said contracts, the Commission agrees with the Corporations respectively:—



1.—(a) To construct a line to transmit the quantities of electric power, shown in column 2 of the said schedule from Niagara Falls to the Corporations shown in column 1, respectively.

(b) On the 19th day of March, 1910, or on any earlier day on which the Commission shall be prepared to supply the same, to supply said power in quantities set forth in column 2 of said schedule, or as a minimum 40 per cent. less, if written notice of minimum required is given on or before 19th July, 1909, to the Corporations within the limits thereof, ready for distribution at approximately the number of volts set forth in column 4 of said schedule, and approximately 25 cycles per second frequency.

(c) At the expiration of three months' written notice, which may be given by the Corporations or any of them from time to time during the continuance of this agreement, to supply from time to time to the Corporations in blocks of not less than 1,000 horse power each, additional power until the total amount so supplied shall amount to 30,000 horse power.

(d) At the expiration of nine months' like notice, which may be given by the Corporations or any of them from time to time during the continuance of this agreement, to supply from time to time to the Corporations in blocks of not less than 1,000 horse power each, additional power until the total amount so supplied shall amount to 100,000 horse power.

(e) To use at all times first-class, modern, standard, commercial apparatus and plant and to exercise all due skill and diligence so as to secure the most perfect operation of the plant and apparatus of the Corporations.

In consideration of the premises and of the agreements herein set forth each of the Corporations for itself, and not one for the other, agrees with the Commission:—

2.—(a) Subject to the provisions of paragraph 2 (g) hereof, to pay the Commission for the quantities of power shown in column 2 of said schedule, or 40 per cent. less as a minimum, to be supplied at said date, and for such additional power supplied or held in reserve upon such notices, the price set forth in column 3 of said schedule in twelve monthly payments, in gold coin of the present standard of weight and fineness, and bills shall be rendered by the Commission on or before the fourth and paid by the Corporations on or before the fifteenth of each month. If any bill remains unpaid for 15 days, the Commission may, in addition to all other remedies and without notice, discontinue the supply of such power to the Corporations in default until said bill is paid. No such discontinuance shall relieve the Corporation in default from the performance of the covenants, provisions, and conditions herein contained. All payments in arrears shall bear interest at the legal rate.

(b) To take electric power exclusively from the Commission during the continuance of this agreement; provided, if the Commission is unable to supply said power as quickly as required, the Corporations may obtain the supply otherwise until the Commission has provided such supply, thereupon the Corporations shall immediately take from the Commission; and the Corporations may generate, store, or accumulate electric power for emergencies, or to keep down the peak

load of the power taken from the Commission; and nothing herein contained shall effect existing contracts between the Corporations and the other parties for a supply of electric power, but the Corporations shall determine said contracts at the earliest date possible.

(c) To pay, annually, interest at four per cent. per annum upon its proportionate part of the moneys expended by the Commission on capital account for the construction of the said line, transformer stations and other necessary works, shown, respectively, in column 6 of said schedule, subject to adjustment under paragraph 10.

(d) To pay an annual sum for its proportionate part of the cost of the construction of said line, stations and works, shown, respectively, in column 6 of said schedule, subject to adjustment under paragraph 10, so as to form in thirty years a sinking fund for the retirement of the securities to be issued by the Province of Ontario.

(e) To bear its proportionate part of the line loss and pay its proportionate part of the cost to operate, maintain, repair, renew and insure the said line, stations and works, shown, respectively, in column 7 of said schedule, subject to adjustment under paragraph 10.

(f) To keep, observe and perform the covenants, provisos and conditions set forth in said contracts, intended by the Commission and the Company to be kept and observed and performed by the Corporations.

(g) To pay for three-fourths of the power supplied and held in reserve at said date and upon said notices, whether the said power is taken or not, and when the greatest amount of power taken for twenty consecutive minutes in any month shall exceed three-fourths of the amount during such twenty consecutive minutes, so supplied and held in reserve, to pay for this greater amount during that entire month. When the power factor of the greatest amount of power taken for said twenty minutes falls below 90 per cent., the Corporations shall pay 90 per cent. of said power divided by the power factor.

(h) To take no more power than the amount to be supplied and held in reserve at said date and upon said notices.

(i) To use at all times first-class, modern, standard, commercial apparatus and plant to be approved by the Commission.

(j) To exercise all due skill and diligence so as to secure the most perfect operation of the plant and apparatus of the Commission and the Company.

3. If as therein provided, the said contracts are continued until 19th December, 1939, this agreement shall remain in force until that date,

4. Said power shall be three phase, alternating, commercially continuous twenty-four hour power every day of the year except as provided in paragraph 6 hereof, and shall be measured by curve-drawing meters, subject to test as to accuracy by either party hereto.

5. The engineers of the Commission, or one or more of them, or any other person or persons appointed for this purpose by the Commission, shall have the right from time to time during the continuance of this agreement to inspect the apparatus, plant and property of the Corporations, and take records at all reasonable times on giving to the Corporation six hours' notice of the intention to make such inspection. The Corporations shall have a like right on giving a like notice to inspect the apparatus, plant and property of the Commission.

6. In case the Commission or the Company shall at any time or times be prevented from supplying said power, or any part thereof, or in case the Corporations shall at any time be prevented from taking said power, or any part thereof, by strike, lock-out, riot, fire, invasion, explosion, act of God or the King's enemies, or any other cause reasonably beyond their control, then the Commission shall not be bound to deliver such power during such time and the Corporations shall not be bound to pay the price of said power at Niagara Falls during such time, but the Corporations shall continue to make all other payments, but as soon as the cause of such interruption is removed the Commission shall without any delay supply said power as aforesaid and the Corporations shall take the same and each of the parties hereto shall be prompt and diligent in removing and overcoming such cause or causes of interruption.

7. If, and so often as, any interruption shall occur in the service of the Company due to any cause or causes, other than those provided for by the next preceding paragraph hereof, the Commission shall recover and pay to the Corporations as liquidated and ascertained damages and not by way of penalty, as follows:— For any interruption less than one hour double the amount payable for power which should have been supplied during the time of such interruption; and for any interruption of one hour or more, the amount payable for the power which should have been supplied during the time of such interruption and twelve times the last mentioned amount in addition thereto, and all moneys payable under this paragraph when the amount thereof is settled between the Commission and the Company may be deducted from any moneys payable by the Corporations to the Commission, but such right of deduction shall not in any case delay the said monthly payments.

8. The maintenance by the Commission of approximately the agreed voltage at approximately the agreed frequency at the sub-station in the limits of the Corporation shall constitute the supply of all power involved herein and the fulfilment of all operating obligations hereunder; and when voltage and frequency are so maintained, the amount of the power, its fluctuations, load factor, power factor, distribution as to phases, and all other electric characteristics and qualities are under the sole control of the Corporations, their agents, customers, apparatus, appliances and circuits.

9. In case any municipal corporation, or any person, firm or corporation which shall contract with the Commission or with any municipal corporation for a supply of power furnished to the Commission by the Company shall suffer damages by the act or neglect of the Company, and such municipal corporation, person, firm or corporation would, if the Company had made the said contracts directly with them, have had a right to recover such damages or commence any proceedings or any other remedy, the Commission shall be entitled to commence any such pro-



ceeding or bring such action for or on behalf of such municipal corporation, person, firm, or corporation, and notwithstanding any acts, decision or rule of law to the contrary, the Commission shall be entitled to all the rights and remedies of such municipal corporation, person, firm or corporation, including the right to recover such damages, but no action shall be brought by the Commission until such municipal corporation, person, firm or corporation shall have agreed with the Commission to pay any costs that may be adjudged to be paid if such proceeding or action is unsuccessful. The rights and remedies of any such municipal corporation, person, firm or corporation shall not be hereby prejudiced.

10. The Commission shall at least annually adjust and apportion the amounts payable by municipal corporations for such power and such interest, sinking fund, line loss, and cost of operating, maintaining, repairing, renewing and insuring the line and works.

11. If at any time, any other municipal corporation, or pursuant to said Act, any railway or distributing company or any other corporation or person, applies to the Commission for a supply of power, the Commission shall notify the applicant and the Corporations, parties hereto, in writing, of a time and place and hear all representations that may be made as to the terms and conditions for such supply.

Without discrimination in favor of the applicants as to the price to be paid, for equal quantities of power, the Commission may supply power upon such terms and conditions as may, having regard to the risk and expense incurred, and paid, and to be paid by the Corporations, parties hereto, appear equitable to the Commission, and are approved by the Lieutenant-Governor-in-Council.

No such application shall be granted if the said line is not adequate for such supply, or if the supply of the Corporations, parties hereto, will be thereby injuriously affected, and no power shall be supplied within the limits of a municipal corporation taking power from the Commission at the time of such application, without the written consent of such corporation.

In determining the quantity of power supplied to a municipal corporation, the quantity supplied by the Commission within the limits of the corporation to any applicant, other than a municipal corporation, shall be computed as part of the quantity supplied to such corporation, but such corporation shall not be liable to pay for the power so supplied, or otherwise in respect thereof. No power shall be supplied by any municipal corporation to any railway or distributing company, or any other corporation or person without the written consent of the Commission.

12. It is hereby declared that the Commission is to be a trustee of all property held by the Commission under this agreement for the Corporations and other municipal corporations supplied by the Commission, but the Commission shall be entitled to a lien upon said property for all moneys expended by the Commission under this agreement and not repaid. At the expiration of this agreement the Commission shall determine and adjust the rights of the Corporations and other municipal corporations, supplied by the Commission, having regard to the amounts paid by them, respectively, under the terms of this agreement, and such other considerations as may appear equitable to the Commission and are approved by the Lieutenant-Governor-in-Council.

13. Each of the Corporations agrees with the other:—

(a) To take electric power exclusively from the Commission during the continuance of this agreement, subject to the provisos above set forth in paragraph 2 (b).

(b) To co-operate, by all means in its power, at all times, with the Commission, to increase the quantity of power required from the Commission, and in all other respects to carry out the objects of this agreement and of the said Act.

14. If differences arise between the Corporations, the Commission may upon application fix a time and place to hear all representations that may be made by the parties and the Commission shall, in a summary manner, when possible, adjust such differences and such adjustment shall be final. The Commission shall have all the powers that may be conferred upon a Commissioner appointed under The Act respecting Enquiries concerning Public Matters.

This agreement shall extend to, be binding upon and enure to the benefit of the successors and assigns of the parties hereto.

In witness whereof the COMMISSION and the CORPORATIONS have respectively, affixed their corporate Seals and the hands of their proper officers.

THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO.

*Commissioners*

## SCHEDULE.

Column 1	2	3	4	5	6	7
Name of Municipal Corporation.	Quantity of power applied for in H.P.	Maximum price of power at Niagara Falls.	No. of volts.	Estimate maximum cost of power ready for distribution in municipality.	Estimate proportionate part of cost to construct transmission line, transformer stations and works for nominally 30,000 H.P., with total capacity of 60,000 H.P.	Estimate proportionate part of line loss and of part cost to operate, maintain, repair, renew and insure transmission line, transformer stations and former stations and works for nominally 30,000 H.P., with total capacity of 60,000 H.P.
Toronto .....	10,000	\$9 40 for power at 12,000 volts until 25,000 H.P. or more are taken, then \$9.00 for all \$10 40 for power at 60,000 volts until 25,000 H.P. or more are taken, then \$10.00 for all. If power taken at higher voltage, price to be fixed by arbitration.	Number required by each corporation.	\$ c. 18 10	\$ 828,080	\$ 38,970
London .....	5,000			23 50	671,089	31,578
Guelph.....	2,500			24 00	347,420	16,350
Stratford .....	1,000			27 10	173,580	8,120
St. Thomas.....	1,500			26 50	244,140	11,490
Woodstock .....	1,200			23 00	155,350	7,310
Berlin .....	1,000			24 00	138,970	6,540
Galt .....	1,200			22 00	143,920	6,773
Hespeler .....	300			26 00	63,200	2,974
St. Mary's.....	500			29 50	95,677	4,502
Preston.....	600			23 50	80,530	3,789
Waterloo.....	685			24 50	98,460	4,630
New Hamburg..	250			29 50	47,830	2,251
Ingersoll....	500			24 00	69,485	3,270



*Estimates for Municipalities during the year 1908.*

The following additional estimates have been made and submitted by your Commissioners for prices of power, distribution, costs, etc:

WESTON: Estimate as to the cost of distributing power to Weston from the Toronto Transformer Station.

EASTERN EXTENSION ESTIMATE: Your Commissioners made an estimate of the cost of delivering power to the following towns in the amounts stated:

Oshawa .....	1,500	H. P.
Bowmanville .....	600	"
Port Hope, A. ....	300	"
Port Hope, B. ....	500	"
Cobourg.....	900	"

The system estimated upon consists of running two 110,000 volt lines from the high tension busbars in the Toronto station, or interswitching station near Toronto, to and through Oshawa, and terminating at Port Hope. The figures were made on the basis of an interswitching station being located at Oshawa, and a step-down transformer station distributing to Oshawa and Bowmanville, and a terminal station located at Port Hope, stepping down to a lower potential for distribution to Port Hope and Cobourg, the towns of Bowmanville and Cobourg to be supplied by two three phase circuits, operating at 13,200 volts, from the stations at Oshawa and Port Hope respectively.

TILLSONBURG: Estimates for an equipment for incandescent and street lighting, and the distribution of power to power consumers.

NORWICH: Estimates of the cost of power for Norwich and the cost of distribution to the consumers.

HAMILTON: Estimates were prepared covering the cost of the distribution of power and street lighting, also estimates as to the cost of placing all wires in the centre of the city underground. A great deal of time was spent by the Engineers in collecting data and information for the city of Hamilton.

BRANTFORD: A great deal of time was also spent on behalf of the city of Brantford estimating the cost of equipment for incandescent and street lighting, etc.

GALT: Estimates were prepared in connection with the cost of equipment for incandescent lighting, pumping and street lighting.

WINDSOR: The Engineers prepared estimates for the city of Windsor for a supply of 5,000, 10,000, 15,000 and 20,000 horse power. A lengthy report was also made on power conditions in Windsor, etc.

WESTERN MUNICIPALITIES: Estimates were made of the cost of the equipment and cost of power to the following municipalities:

Windsor	}	.....	5,000	H. P.
Walkerville				
Sandwich				
Bothwell .....			225	"
Dresden .....			200	"
Chatham .....			600	"
Leamington.....			250	"
Essex .....			100	"
Ridgetown.....			250	"
Thamesville .....			150	"
Tilbury .....			200	"
Blenheim .....			200	"
Comber.....			200	"
Wallaceburg .....			500	"
Amherstburg .....			350	"
Kingsville .....			650	"

## HYDRAULIC WORK.

*Reports on Water Powers for Municipalities.*

Your Commissioners have during the year, in accordance with paragraph 11 of the Power Commission Act, examined and investigated water powers and privileges, and reported upon the value and capacity thereof, for various municipalities throughout the Province. The following is a list of water powers investigated and hydraulic reports made in connection with the same, acting upon resolutions passed by the various councils requesting the services of the Engineers.

*Hydraulic Reports, 1908.*

(1) Report prepared in compliance with the request of the Canadian Manufacturers' Association, outlining a method of collecting, tabulating and publishing accurate hydraulic data, in connection with the rivers of the Province of Ontario, describes the information necessary to be collected, scheme of organization, and estimate of capital investment and annual cost of administration.

(2) Report prepared for the Municipality of Massey, giving information as to the possibility of developing power on the Sable River, includes estimates of the cost of developing full capacity and half capacity on each of two power locations adjacent to the town.

(3) Report prepared for the Municipality of Bancroft, giving information as to the power possibilities of the York branch of the Madawaska River, and the power capacity of various power-sites in the vicinity. Also estimate giving the cost of developing power upon a site within the town.

(4) Report prepared for the Municipality of Renfrew, giving information as to the power capacity of various available sites upon the Bonnechere and Madawaska Rivers. Also an estimate giving the cost of developing a site within the town for municipal purposes.

(5) Report prepared for the Municipality of Blind River, giving information as to the possibility of developing power at various available sites on the Blind River. Gives estimates upon cost of developing full capacity and half capacity **at White Falls and transmitting power to Blind River.**

(6) Report prepared for the Municipality of Sault Ste. Marie in connection **with the possibility of developing power at the Whitefish Channel.** Outlines scheme for insuring continuous flow in channel, and discusses scheme of development and obstacles in the way of acquiring the property for power purposes.

(7) Report prepared for the Municipality of Almonte, giving information as to the power capacity and storage possibilities of the Mississippi River. Also giving estimates of cost of developing full capacity and half capacity at each of two available sites within the town for municipal purposes.

(8) Report prepared for the Municipality of Peterboro, giving information as to the power capacity of the Otonabee River, and discussing various available sites on the river, with a view to advising the city as to the best location for the establishment of a municipal plant. Also includes estimate of cost of development **at Burleigh Falls and cost of transmitting power to Peterboro.**

(9) Report prepared for the Municipality of Bruce Mines, giving information as to the power possibilities of the Mississauga River. Also an estimate giving cost of developing half capacity and full capacity at Squaw Chute, on the Mississauga, and transmitting power to Bruce Mines.

(10) Report prepared for the Municipality of North Bay, giving information as to power capacity of Smoky Falls, on the Sturgeon River. Also gives estimate of cost of developing full capacity and half capacity, and transmitting power to North Bay.

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## HYDROGRAPHIC SURVEY.

HON. ADAM BECK,

*Chairman, Hydro-Electric Power Commission.*

DEAR SIR,—Submitted, herewith, is a report, the purpose of which is to outline a method of dealing with the question brought up in the letter of the Secretary of the Canadian Manufacturers' Association dated March 12th, 1908, and addressed to the Premier; namely, a practical method whereby detailed and accurate hydraulic data, in connection with the water powers of the Province of Ontario, could be collected, tabulated and published in such a way as to be readily accessible to the general public; the same being accompanied by estimates of initial investment and annual cost of administration in connection with the various schemes, as outlined.

In the first place, the cost of administering such a scheme will vary directly with the refinements introduced into the engineering methods, and the degree of accuracy required in connection with work in the field. Also, if the information obtained is to have weight, the period of investigation must extend over a number of years, it being necessary to determine the time and amount of maximum average and minimum flow and to investigate and record the behaviour of the different streams under various conditions. It is evident, therefore, that the longer the period of time over which the investigation extends, the more reliable will be the information resulting therefrom.

Of the different schemes outlined, the first is the only one which approaches completeness, the rest being simply modifications of the first, which are to be recommended only because they appear cheaper.

*Scheme No. 1.*

This scheme is intended to cover the same territory as that covered by the five reports of the first Commission; namely, the whole of the Province of Ontario with the exception of the James Bay watershed.

For purposes of investigation this territory will be divided into the following:

*District A—*

To include the Niagara, Grand, Thames, Maitland and Saugeen Rivers with their tributaries.

*District B—*

To include the St. Lawrence, Rideau, Moira, Trent, Otonabee, Gananoque and Credit Rivers.

*District C—*

To include the Ottawa, Mississippi, Madawaska, Petewawa, Mattawa, Montreal and Blanche Rivers.

*District D—*

To include the Severn, Muskoka, Moon, Muskosh, Magnetawan, South, French and Sturgeon Rivers.

*District E—*

To include the Wahnapiatae, Spanish, Vermilion, Onaping, Whitefish, Sable, Blind, Mississauga, Thessalon and St. Marys Rivers.

*District F—*

To include the Michipicoten, Magpie, Steel, Black, Nipigon, Current, Kaministiquia and Mattawin Rivers.

*District G—*

To include the Seine, Wabigoon, Pigeon, Rainy, English and Winnipeg Rivers.

Each of the above mentioned districts should be in charge of a hydrographer, who, with the help of an assistant, would look after all the work in the district assigned to him. Each hydrographer should be supplied with a current meter, an engineer's level, an aneroid, a compass, a hand-level, sounding rods, ropes, etc. A canoe will in some cases also be required.

To cover the Province thoroughly, at least 80 gauging stations should be established, from one to five stations being established in the watershed of each river included in the scheme. The distribution of these stations is as follows:—

District A—17 stations.	District B—12 stations.	District C—14 stations.
“ D—13 “	“ E—10 “	“ F—9 “
“ G—7 “		

During the open season the hydrographers would travel continually in their respective districts, visiting the various gauging stations in rotation and making determinations of flow as frequently as possible. During the winter, when gauging operations must necessarily become less frequent, spare time can be fully occupied in reconnaissance work, such as profiling river beds, computing storage areas, measuring heads, studying ice conditions, and making approximate surveys of sites for storage dams. This class of work can be more conveniently done during the winter, so that the time of the outdoor staff could be fully occupied throughout the year.

Water level gauges should be established at each gauging station to be read each time discharge measurements are to be taken. Permanent level gauges should also be established where it will be possible to obtain readings at least once a day, gauge readers being appointed for this purpose.

In addition to the purely hydraulic information, the investigation would not be complete without making a study of, and recording the climatic conditions in the watersheds of the various rivers. For this purpose a certain number of gauge recorders could be detailed, for an extra consideration, to make and record observations of rain and snow fall, wind velocity and temperature.

To cover the territory above described about 63 gauge recorders should be appointed, and 17 of these should be supplied with equipment for making weather reports.

The distribution of gauge recorders would be as follows:—

Section A—17 stations.	Section B—12 stations.	Section C—8 stations.
“ D—9 “	“ E—7 “	“ F—6 “
“ G—4 “		

Of the combined weather and gauge recorders there would be

In Section A—3 stations.	Section B—3 stations.	Section C—3 stations.
“ D—2 “	“ E—2 “	“ F—2 “
“ G—2 “		

This scheme as outlined above, is designed to give reasonably full and complete information with regard to the rivers above specified. This information

will enable all the necessary calculations to be made with reference to annual precipitation, annual evaporation, available run-off, storage capacity, discharge phenomena, power capacity, etc. Sufficient data will also be available for estimating on the improvement of such rivers as the Grand and the Thames, which have been ruined by deforestation.

#### ESTIMATED CAPITAL COST OF SCHEME NO. 1.

Hydrographers instruments and outfits .....	\$3,583
Cost of establishing gauging stations.....	2,400
"    "    level gauge .....	650
"    "    rating station .....	600
"    "    weather stations .....	1,275
Stationery, record books, etc.....	150
Total .....	\$8,408

#### ESTIMATED ANNUAL COST OF SCHEME NO. 1.

Salaries of engineering staff .....	\$19,360
"    "    gauge recorders .....	6,720
Maintenance and repairs on instruments, 10 per cent. ....	360
"    "    "    gauging stations .....	430
Travelling expenses.....	8,000
Stationery and postage .....	150
Total.....	\$35,020

#### *Scheme No. 2.*

In this instance the Province will be divided as follows:—

##### *Section A—*

To include the Niagara, Grand, Maitland, Saugean, Thames, Severn and Credit Rivers.

##### *Section B—*

To include the St. Lawrence, Moira, Trent, Otonabee, Rideau, Moon, Muskosh, Muskoka, French, Magnetawan and South Rivers.

##### *Section C—*

To include the Ottawa, Mississippi, Madawaska, Petewawa, Mattawa, Montreal, Blanche, Sturgeon, Whitefish and Wahnapiatae Rivers.

##### *Section D—*

To include the Spanish, Vermilion, Onaping, Sable, Blind, Mississauga, St. Marys, Michipicoten and Magpie Rivers.

##### *Section E—*

To include the Nipigon, Kaministiquia, Mattawin, Pigeon, Wabigoon, Rainy and Winnipeg Rivers.

Under this arrangement the districts covered by each hydrographer are enlarged, so that gauging will be less frequent. No gauge recorders have been employed in the territory west of Sudbury, the level gauges at the various



stations being read by the hydrographers at the time of measuring flow only. Also no provision is made for taking weather records in this case, and the present government records will be relied on for this class of information.

While this scheme will reduce the annual charges, it will also reduce the amount of information collected in a given time, so that there will be no ultimate saving, if the investigations are continued long enough to furnish data as copious and reliable as in the case of Scheme No. 1.

#### ESTIMATED CAPITAL COST OF SCHEME NO. 2.

Hydrographers' instruments and outfits .....	\$2,640 00
Cost of establishing gauging stations .....	1,875 00
Cost of establishing level gauges .....	450 00
Cost of establishing rating stations .....	600 00
Stationery, record books, etc. ....	150 00
<b>Total .....</b>	<b>\$5,715 00</b>

#### ESTIMATED ANNUAL COST OF SCHEME NO. 2.

Salaries of engineering and office staff .....	\$14,300 00
Salaries of gauge readers .....	2,400 00
Maintenance and repairs on instruments, 10% .....	260 00
Maintenance and repairs on stations, 10% .....	230 00
Travelling expenses .....	6,000 00
Stationery and postage .....	150 00
<b>Total .....</b>	<b>\$23,340 00</b>

#### *Scheme No. 3.*

In this case it is proposed to omit the Districts of Algoma, Thunder Bay and Rainy River, and for the present to confine their detailed investigations to the older parts of the province, the subdivision of districts being the same as in the case of Scheme No. 2. By dividing this territory into three districts, each in charge of a hydrographer and assistant, as before, it should be possible to get at least one gauging per month at each station in the district. Gauge recorders have been dispensed with entirely, and water level readings will be taken by the hydrographers only, as previously explained. Weather records have been dispensed with in this case also, and this scheme will represent about the minimum of outlay through which any results worth publishing can be obtained within a reasonable time.

#### ESTIMATED CAPITAL COST OF SCHEME NO. 3.

Hydrographers' instruments and outfits .....	\$1,657 00
Cost of establishing gauging stations .....	1,650 00
Cost of establishing rating stations .....	600 00
Stationery, record books, etc. ....	100 00
<b>Total .....</b>	<b>\$4,007 00</b>

#### ESTIMATED ANNUAL COST OF SCHEME NO. 3.

Salaries of engineering and office staff .....	\$9,940 00
Maintenance and repairs on instruments .....	165 00
Maintenance and repairs on stations .....	160 00
Travelling expenses .....	4,800 00
Stationery and postage .....	100 00
<b>Total .....</b>	<b>\$15,166 00</b>

The most important branch of work in connection with this scheme is the discharge measurement, and a sufficient sum has been provided in the foregoing estimates for the material and workmanship to establish permanent gauging stations where required.

These stations are of four general classes: bridge stations, cable stations, boat stations and triangulation stations.

Bridge stations are stations where gauging operations can be carried on over the railing of a bridge. Locations of this type can be found on such rivers as the Thames and Grand.

Cable stations are stations where soundings and velocity measurements are made from a travelling bucket suspended from a cable stretched across the stream. This method is used in the case of large non-navigable streams, of which a typical example is the west branch of the Winnipeg River at Kenora.

Both stations are established on rivers where sufficient accuracy can be attained by temporarily stretching a tagged rope across the stream and carrying on gauging operations from a boat or canoe. This is the most general method and is more or less applicable to all the rivers in the province with the exception of the larger boundary rivers.

The triangulation method is necessary only in the case of very large streams like the St. Lawrence, Niagara or Ottawa. In this case the location of soundings and velocity measurements is determined instrumentally by triangulation. The gauging of these large rivers will require extra precautions and additional staff, and the cost is not included in the foregoing estimates.

Water level gauges will be established at each gauging station for the purpose of maintaining the important relation between water level and discharge. Gauges from which daily records are to be made will be located where they can be most conveniently reached by the recorder, so as to consume as little of his time as possible and thus cut down expenses.

District topographers and gauge recorders will transmit their records and observations in the form of weekly reports to the Toronto office, where they will be classified and tabulated, and all calculations will be performed by the office staff.

It would seem advisable to have all this data on file at the Toronto office, where it would be accessible to the general public. Eventually, say in not less than four years, the results could be published from time to time in the form of detailed reports upon each important river in the Province. Reliable information presented in this manner would be of great value and would go far towards advertising the hydraulic resources of the Province of Ontario.

All of which is respectfully submitted.

CHIEF ENGINEER.

MASSEY.

### *Re Power for Municipality.*

#### *Power Requirements.*

The market at present existing in the town is not of sufficient importance to warrant development on the locations available, and the report was asked for with a view to obtaining power which could be held out as an inducement for the establishment of manufacturing industries.

*Source of Power.*

The most convenient source of power for the municipality is the Sable River, which empties into the Spanish River close to the town. A number of good natural heads exist, two of the best of which are within a mile of the town.

This river is rather deficient in natural storage facilities, and the capacity for peak load storage at the power sites is also limited owing to lack of pondage, but the watershed of the river is of sufficient extent to make possible the development of considerable blocks of power under conditions of minimum flow.

*Available Sites.*

Of the available sites, the two best suited to the requirements of the municipality are Graveyard Chute and Spanish Chute, one mile and one-half of a mile respectively from the town. As regards pondage for peak load accommodation, there is nothing to choose between the two sites. The total available head at the Graveyard Chute is 55 feet, while that at Spanish Chute is not more than 43 feet, but to utilize the full head in the first case would require a much more complicated scheme of development than would be required at the Spanish Chute, where the scheme of development would be comparatively simple, and it will require comparative estimates to ascertain which development is the more favorable from a standpoint of economy.

*Power Capacity.*

The discharge of the Sable River is sufficient to produce about 20 continuous 24-hour horse power per foot of head under conditions of minimum flow. This amount of power was available at the time of inspection, but owing to the fact that the flow of the river is controlled by the lumber interests, during the time of the annual drive it is not at all certain that there will be enough surplus water, over and above that required for driving purposes, to produce the above mentioned capacity all the year round. Some additional investigation will be necessary during the progress of the drive to determine this.

*Development.*

The natural head at Graveyard Chute could be increased to 55 feet by placing suitable overflow dams in each channel and carrying a flume and penstock across the bend in the river to tailwater. Under these conditions, and assuming as above stated, a capacity of 20 horse power per foot of head, the full development would produce 1,100 horse power at the turbine shaft.

The natural head at the Spanish Chute could be very easily increased to 43 feet by means of a dam at the head of the chute. Under this head, and with the same assumption as before, as to minimum capacity per foot of head, the full development would produce 860 horse power at the turbine shaft.

As the existing market is small, an estimate based on present or immediate future demand would force the annual cost of power beyond reasonable limits. Two estimates will, therefore, be submitted for each development, one for full capacity and one for half capacity, the power to be delivered at the outskirts of the town and all losses allowed for in each case.

The capital costs for the full load estimates will include the construction cost of permanent works, and the cost of hydraulic and electrical equipment, all for full capacity. The annual charges in each case include depreciation and maintenance, interest or capital investment and operation and administration.



The half load estimates provide for permanent works for full capacity, but hydraulic and electric for half capacity only. Otherwise these estimates are figured along the same lines as those for full load, both as regards capital investment and annual charges. No spare equipment is provided in either case.

It may be said that the remarkable similarity of the figures in these two sets of estimates is merely a coincidence, as the estimates were worked out quite independently of each other, and have not been altered or adjusted in any way. On the showing of these estimates, the Spanish Chute appears to be the more favorable site on account of the shorter distance to town.

While this report is of an advisory nature only, it is based upon information which should be sufficiently reliable to form a safe estimate of the possibilities, in case the municipality should see fit to take definite action with regard to development.

GRAVEYARD CHUTE.—ESTIMATE No. 1—FULL CAPACITY.

Provides for the delivery at the Power House switchboard of 1,000 horse power ready for local distribution in the Town of Massey.

*Capital Investment.*

Dam, Power House and permanent works .....	\$18,750 00
Excavation and false work .....	7,000 00
Hydraulic equipment .....	8,000 00
Electrical equipment .....	21,750 00
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Engineering and contingencies, 10% .....	\$55,500 00
	5,550 00
	<hr/>
Interest during construction, 3% .....	\$61,050 00
	1,831 00
	<hr/>
Total capital cost .....	\$62,881 00

*Annual Charges.*

Dam, Power House and permanent works .....	\$493 00
Hydraulic equipment .....	435 00
Electrical equipment .....	1,275 00
	<hr/>
Engineering and contingencies, 10% .....	\$2,203 00
Annual interest on \$63,000 at 5% .....	220 00
Sinking fund, 1.51% .....	3,150 00
Operation and administration .....	951 00
	<hr/>
Total annual charges .....	3,000 00
	<hr/>
	\$9,524 00

Cost of 1 H.P. to build on basis of 1,000 H.P. delivered, \$63.00.

Annual cost of 1 H.P. on basis of 1,000 H.P. delivered, as above specified, \$9.52.

GRAVEYARD CHUTE.—ESTIMATE No. 1—HALF CAPACITY.

Provides for the delivery at the Power House switchboard of 500 horse power ready for local distribution in the Town of Massey.

*Capital Investment.*

Dam, Power House and permanent works .....	\$18,750 00
Excavation and false work .....	7,000 00
Hydraulic equipment .....	4,500 00
Electrical equipment .....	11,425 00
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Engineering and contingencies, 10% .....	\$41,675 00
	4,168 00
	<hr/>
Interest during construction, 3% .....	\$45,843 00
	1,375 00
	<hr/>
Total capital cost .....	\$47,218 00

*Annual Charges.*

Dam, Power House and permanent works .....	\$493 00
Hydraulic equipment .....	245 00
Electrical equipment .....	668 00
	<hr/>
	\$1,406 00
Engineering and contingencies, 10% .....	141 00
Annual interest on \$47,300 at 5% .....	2,365 00
Sinking fund, 1.51% .....	714 00
Operation and administration .....	2,500 00
	<hr/>
Total annual charges .....	\$7,126 00

Cost of 1 H.P. to build on basis of 500 H.P. delivered, \$95.00.

Annual cost of 1 H.P. on basis of 500 H.P. delivered, as above specified, \$14.25.

## SPANISH CHUTE.—ESTIMATE NO. 2.—FULL CAPACITY.

Provides for the delivery at the Power House switchboard of 860 horse power ready for local distribution in the Town of Massey.

*Capital Investment.*

Dam, Power House and permanent works .....	\$15,350 00
Excavation and false works .....	9,200 00
Hydraulic equipment .....	8,650 00
Electrical equipment .....	18,550 00
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	\$51,750 00
Engineering and contingencies, 10% .....	5,175 00
	<hr/>
	\$56,925 00
Interest during construction, 3% .....	1,708 00
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Total capital cost .....	\$58,633 00

*Annual Charges.*

Dam, Power House and permanent works .....	\$356 00
Hydraulic equipment .....	468 00
Electrical equipment .....	1,083 00
	<hr/>
	\$1,907 00
Engineering and contingencies, 10% .....	191 00
Annual interest on \$59,000 at 5% .....	2,950 00
Sinking fund, 1.51% .....	891 00
Operation and administration .....	2,500 00
	<hr/>
Total annual charges .....	\$8,439 00

Cost of 1 H.P. to build on basis of 860 H.P. delivered, \$68.00.

Annual cost of 1 H.P. on basis of 860 H.P. delivered, as above specified, \$9.82.

## SPANISH CHUTE.—ESTIMATE NO. 2—HALF CAPACITY.

Provides for the delivery at the Power House switchboard of 430 horse power ready for local distribution in the Town of Massey.

*Capital Investment.*

Dam, Power House and permanent works .....	\$15,350 00
Excavation and false work .....	9,200 00
Hydraulic equipment .....	4,850 00
Electrical equipment .....	9,725 00
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Engineering and contingencies, 10% .....	\$39,125 00
	3,913 00
	<hr/>
Interest during construction, 3% .....	\$43,038 00
	1,291 00
	<hr/>
Total capital cost .....	\$44,329 00

*Annual Charges.*

Dam, Power House and permanent works .....	\$356 00
Hydraulic equipment .....	263 00
Electrical equipment .....	566 00
	<hr/>
	\$1,185 00
Engineering and contingencies, 10% .....	119 00
Annual interest on \$44,300 at 5% .....	2,215 00
Sinking fund, 1.51% .....	669 00
Operation and administration .....	2,000 00
	<hr/>
	\$6,188 00

Cost of 1 H.P. to build on basis of 430 H.P. delivered, \$103.00.

Annual cost of 1 H.P. on basis of 430 H.P. delivered, as above specified, \$14.40.

## BANCROFT.

*Re Power for the Municipality.**Power Requirements.*

The market at present existing in this municipality is insignificant, and would not afford sufficient inducement in itself for extensive hydraulic development. This report will, therefore, be submitted for the purpose of indicating the amount of power available for the development of the mineral and timber resources of the surrounding territory; also the probable capital and annual cost of stated quantities of power developed at the site most convenient to the municipality.

*Source of Power.*

The source of power available for this municipality is the York branch of the Madawaska, which flows through the town. The watershed of this tributary has an area of about 400 square miles, and is well supplied with natural storage basins. In addition to this, the watershed embraces a considerable timbered area, and the stream derives a large portion of its flow from underground waters. These conditions tend to produce uniformity of flow, and in this respect the York branch is better suited for power purposes than most rivers of its class in the Province.



*Available Sites.*

A number of good natural heads exist on this river within easy transmission distance of the town, the most important of which are High Falls, Crooked Rapids, Lavellee's Rapids and the rapids adjacent to the town. While development is quite feasible at all these locations, the last mentioned is the one best suited to the town's requirements, both as regards power capacity and economy in development.

*Power Capacity.*

At the time of inspection the discharge of the York River was sufficient to produce at least 50 horse power per foot of head. It is not at all probable that this amount of power would be continuously available. However, in view of the favorable nature of the watershed, and the fact that the Baptiste Lake dam, which controls 15 square miles of storage area, is located not more than eight miles from the town, it would be reasonable to assume a minimum discharge of 250 second feet, which is equivalent to 23 horse power continuous 24-hour power per foot of head. It is to be understood, however, that an investigation of low-water conditions may cause this figure to be changed.

Using this figure as a basis, the town rapids would have a total minimum capacity of 500 horse power, High Falls 1,000 horse power, Crooked Rapids 800 horse power and Lavellee's Rapids 800 horse power, so that there is probably 3,000 horse power continuous 24-hour power within transmission distance of the town, which could be developed as the demand required.

*Development.*

By combining the present Rathbun dam with the rapids just below, an effective head of 22 feet could be obtained, and a proper scheme of development for full capacity would involve the replacing of the present dam by a more permanent structure and the building of a flume down the left bank of the stream between the dam and the power house site. The dam and flume would comprise the main feature of the development as regards first cost, and would also materially affect the annual cost of power.

As before mentioned, the existing market is small, and an estimate based on present demand would force the annual cost of power beyond reasonable limits. Two estimates will, therefore, be submitted, providing for the generation of certain specified quantities of power, the same to be delivered at the busbars ready for distribution.

The first estimate will be for full capacity, and will include construction, cost of permanent works, hydraulic and electrical equipment, an allowance for engineering, and contingencies and interest during construction. Annual charges will include depreciation and maintenance, interest on investment, and operation and administration.

The second estimate will provide permanent works and power house space for full capacity, but hydraulic and electrical equipment for direct current only. Otherwise the half-load estimate will be figured on the same basis as that for full load.

In order to obviate the necessity for installing a new distribution system for lighting, both estimates will provide for the installation of a direct current unit of sufficient capacity to handle the municipal lighting load for some time to come.

The permanent works are of concrete construction, the dam having concrete abutments, piers and headblock, and the flume is of the reinforced concrete type. The power house foundations are of concrete and steel, but the superstructure is of wood. No automatic governing apparatus has been installed.

#### *Storage.*

The facilities for artificial storage upon this river are unusually good, the principal controlling point being the Rathbun dam at the foot of Baptiste Lake. This dam at the present time undoubtedly has a very beneficial influence upon the river as regards uniformity of flow, and if the discharge through the dam could be controlled for power purposes exclusively, this influence would be still more marked. At the present time large quantities of water are wasted in taking out the spring drive, as there are no slides on the river.

The amount of annual precipitation over the watershed is seldom less than 30 inches, and of this 15 inches should be available for power purposes. The total available precipitation on the watershed (400 square miles) would then be about 14,000 million cubic feet. Assuming 15 square miles of area in Baptiste and a storage run-off of five feet, the reserve capacity of this reservoir would be 2,100 million cubic feet. This amount of water would supply 22 horse power per foot of head for 100 days, leaving 11,900 million cubic feet to be discharged naturally.

In conclusion, it is to be understood that the function of this report is advisory only, and while it gives a reasonable indication of the possibilities, no definite steps toward development should be taken until a certain amount of reliable hydraulic information has been obtained in connection with the river, and until a detailed survey of the power site has been made, from which it will be possible to prepare an accurate estimate.

#### ESTIMATE No. 1.

Provides for generation of full capacity, 500 H.P.

#### *Capital Investment.*

Dam, head works and Power House .....	\$8,600 00
Excavation and false work .....	7,400 00
Hydraulic equipment .....	10,300 00
Electrical equipment .....	11,450 00
	<hr/>
	\$37,750 00
Engineering and contingencies, 10% .....	3,775 00
Interest during construction, 3% .....	1,246 00
	<hr/>
Total capital investment .....	\$42,771 00
Cost of 1 H.P. to build on basis of 500 H.P. delivered, \$85.50.	

#### *Annual Charges.*

Dam, head works and Power House .....	\$261 00
Hydraulic equipment .....	425 00
Electrical equipment .....	652 00
	<hr/>
	\$1,338 00
Engineering and contingencies, 10% .....	134 00
	<hr/>
	\$1,472 00
Annual interest on \$42,770 at 5% .....	2,139 00
Sinking fund, 1.51% .....	646 00
Operation and administration .....	2,800 00
	<hr/>
Total annual charges .....	\$7,057 00
Cost of 1 H.P. annually on basis of 500 H.P. delivered at switchboard, \$14.12.	

## ESTIMATE No. 2.

Provides for generation of 150 H.P. direct current.

*Capital Investment.*

Dam, head works and Power House .....	\$8,300 00
Excavation and false work .....	7,400 00
Hydraulic equipment .....	6,300 00
Electrical equipment .....	4,050 00
	<hr/>
	\$26,050 00
Engineering and contingencies, 10% .....	2,605 00
Interest during construction, 3% .....	860 00
	<hr/>
Total capital investment .....	\$29,515 00

Cost of 1 H.P. to build on basis of 150 H.P. delivered, \$197.00.

*Annual Charges.*

Dam, head works and Power House .....	\$213 00
Hydraulic equipment .....	225 00
Electrical equipment .....	224 00
	<hr/>
	\$662 00
Engineering and contingencies, 10% .....	66 00
Annual interest on \$29,500 at 5% .....	1,475 00
Sinking fund, 1.51% .....	446 00
Operation and administration .....	2,500 00
	<hr/>
Total annual charges .....	\$5,149 00

Cost of 1 H.P. annually on basis of 150 H.P. delivered at switchboard, \$34.33.

## RENFREW.

*Re Power for Municipality.**Power Requirements.*

This report was solicited by the Town of Renfrew for the immediate purpose of obtaining advice as to the practicability of developing a small power within the municipality for operating the waterworks and street lighting systems. In addition to this, information was asked for in connection with several other water-powers in the vicinity, with a view to future development.

The market at present existing in the town is fairly well supplied by existing developments, and in view of this fact the development of any large block of power by the municipality would not be a commercial proposition, unless there was definite assurance of the establishment of industries requiring an aggregate of 400 to 500 horse power.

The immediate need, as before mentioned, is in connection with the water-works. The system is at present operated by means of a motor-driven turbine pump, the power for which is supplied by the Renfrew Power Company. This company, under present conditions, has only sufficient capacity to meet the increasing requirements of its private customers, and they are unwilling to renew the town contract, which expires in July next, under the present terms. It was therefore considered advisable for the town to seek some other means of supplying the necessary amount of power, and the discussion of this question is the main purpose of the report herewith submitted.



*Sources of Power.*

The most convenient source of power for the municipality is the Bonnechere River, which flows through the town. A number of good natural heads exist on this river, one of the best being within the Corporation limits, and two others are within easy transmission distance.

Under present natural conditions this river is capable of delivering about 15 horse power continuous 24-hour power per foot of head at extreme low water in the vicinity of Renfrew, and this figure could probably be doubled by artificial storage.

Another possible source of power for the town is the Madawaska, which in the neighborhood of Renfrew is capable of delivering about 80 horse power continuous 24-hour power per foot of head under low-water conditions.

*Storage Possibilities.*

The Bonnechere River is well supplied with natural storage basins, and the power users along the river would benefit very greatly by their development.

The topographical conditions are not such as to warrant extensive dam construction, the shores of the lakes being low at the outlets and also around the greater portion of their circumference. A number of settlers are located around these lakes, and the danger of interfering with private property appears to be the main obstacle in the way of utilizing them for storage.

The combined area of Round and Golden Lakes is at least 30 square miles and if the mean level of these lakes were raised only two feet by means of storage dams sufficient water would be impounded to produce double the present low water flow for a period of three months. The power users along this river could profitably invest a large sum of money in acquiring rights from any settlers whose property would be in any way affected by the construction of storage dams.

*Available Sites.*

Of the power sites available for development, the most important are the First Chute on the Bonnechere, eight miles below Renfrew; the Fourth Chute on the Bonnechere, 16 miles above Renfrew; the Burnstown Rapids on the Madawaska, eight miles from Renfrew; and the upper portion of the Second (?) Chute on the Bonnechere, within the Renfrew Corporation Limits, hereinafter called the Hough Property.

*Power Capacity.*

The minimum available head at the First Chute may be taken at 32 feet. With this head and a power capacity of 15 horse power per foot head this site should be able to develop 500 horse power continuous power. A wooden dam about 14 years old is at present located at the head of the chute, which might serve temporarily, but in the event of full development it would have to be torn out and replaced by a more permanent structure.

The head available at the Fourth Chute is about 46 feet, and the flow will be slightly less than in the case of the First Chute. This site, fully developed, would have a capacity of about 600 horse power continuous power. There is a concrete dam on the property, which probably could be utilized in the case of full development.

In the case of the Burnstown site no concentrated head exists, and for development it would be necessary to create an artificial head by means of a dam, and

the capacity of the site would be limited practically by the capital investment applied to the dam construction, which would be the main feature of the development, the river channel being 300 to 400 feet wide at this point. A 10-foot dam at this point would make about 800 horse power available, a 15-foot dam 1,200 horse power, and so on.

With regard to the three locations above specified, it may be said that development is structurally feasible in each case, but the economic features of the problem are not so favorable. If an unsupplied demand for, say, 500 horse power existed in the town at the present time, the full development of either the First or Fourth Chutes could be safely recommended. This, however, is not the case as regards the power market, and either of the above propositions would seem at present to be of a rather too speculative nature for the municipality to handle with safety.

The available low-water head on the Hough property may be figured at 10 feet, and the high-water head at about 7 feet. In extreme low water this site would then be capable of developing 150 horse power continuous power. In high-water periods 50 horse power per foot of head could be relied on, so that the high-water capacity of the site would be at least 350 horse power.

At the present time the waterworks system uses 50 horse power under normal operating conditions and the arc light system 30 horse power. It is evident, therefore, that a plant of 150 horse power minimum capacity will meet the town's requirements for a long time to come. Also, the fact that the Hough property is in the Corporation limits will tend to make the capital and operating charges a minimum. The development of any of the more remote locations would mean trebling the investment, and doubling or trebling the annual charges, permanent works being installed for a capacity which would probably not be utilized for years.

In view of existing circumstances, the development of the 10-foot head on the Hough property would appear to be the only proposition worth considering in detail, and on this assumption the following estimate is submitted.

### *Scheme of Development.*

On account of the low fluctuating head, it will be necessary to install the hydraulic plant in an open flume, with two single vertical shaft wheels geared to a jack shaft, and the generator driven therefrom by means of a belt. For speed regulation under varying head it may be necessary to install double-faced pulleys on shaft and generator, leaving sufficient space on the slide rails to adjust the belt for changes in speed, in case the gateage of the wheels proves unable to handle it.

It has been considered advisable to install a generator for the full capacity of the plant, and to operate the arc system direct, and the waterworks by means of a motor pumping set, as at present. Provision will also be made for a belt drive, so that in case of accident to the electrical apparatus the pump can be driven direct from the wheels. To further insure the continuity of the water service, the town should install an emergency line and switching apparatus, to allow of temporary connection to the Renfrew Power Company's plant in case of accident to the wheels, or during repairs. In this way it should be possible to dispense with the steam plant, as required at present by the underwriters.

The following estimate is based on the assumption that a 10-foot head will be available at low-water, and that tail-water will rise not more than four feet at flood-time, with a corresponding rise of one to two feet in head-water, making seven to eight feet of head available in high water.

*Estimates.*

The attached estimate includes the construction of a tight concrete dam in place of the one already existing on the property; also a concrete head race and power house, with space for one 100 kilowatt alternating current generator and a turbine pump unit. The hydraulic equipment will consist of two vertical shaft wheels each of 80 horse power rating under a 10-foot head, these being arranged to operate either separately or in parallel. An approximate sum has also been included to cover changes in the piping system.

The total capital investment includes cost of permanent works, hydraulic, electrical and pumping apparatus, an allowance for engineering, and contingencies and interest during construction. Annual charges include depreciation and maintenance, interest on investment, sinking fund, and operation and administration.

It is to be noted that this estimate is of a preliminary nature only, as there was not sufficient data available for an accurate estimate. It is believed, however, that the figures herewith submitted are sufficiently close to furnish a safe and reasonable estimate of the obligations the town will assume should the project take definite shape.

## ESTIMATE.

Dam, head work and Power House .....	\$6,000 00	\$120 00
Hydraulic equipment .....	2,800 00	140 00
Electrical equipment .....	3,900 00	234 00
Pumping equipment .....	2,500 00	150 00
Excavation and false work .....	2,900 00	....
Alterations in piping system (say) .....	2,500 00	....
	<hr/>	<hr/>
Engineering and contingencies, 10% .....	\$20,600 00	\$644 00
Interest during construction, 2½% .....	2,060 00	....
Annual interest, 5% .....	515 00	....
Sinking fund, 1.51% (30 years) .....	....	1,159 00
Operation .....	....	351 00
	<hr/>	<hr/>
Grand total .....	\$23,175 00	\$3,154 00

The above totals would apply at present to a capacity of about 80 horse power, but they would not be appreciably greater for the full-rated capacity of 150 horse power, so that the annual cost per horse power would decrease directly as the lighting and water services expanded.

In the above estimate not more than half of the total annual charges should apply to the waterworks portion of the power plant. This being the case the annual charges on the water system for power amount to \$1,577 per year. Add to this \$6,220 for the present annual charges on waterworks, after deducting the cost of fuel, and the sum of \$7,797 is obtained for the total annual charges on the waterworks system. Against this may be placed a total revenue of \$11,000, which is a safe estimate for the year ending December 31st, 1908.

It is to be noted that this estimate does not include the cost of the privilege, which had not been obtained at the time of investigation. The increase in capital and annual charges due to this can be easily calculated.

Toronto, December 17th, 1908.



## BLIND RIVER.

### *Re Power for Municipality.*

#### *Power Requirements.*

The market at present existing in the town is not of sufficient importance to warrant development on the locations available, and the report was asked for with a view to obtaining power prices which could be held out as an inducement for the establishment of manufacturing industries.

#### *Source of Power.*

The natural source of power for the municipality is the Blind River, upon which are several good sites for development within easy transmission distance. This river is remarkable in that its natural storage capacity is very large in proportion to its drainage area. This has a tendency to produce a more uniform flow than is usual among the smaller rivers along the north shore, and adds very materially to its usefulness as a source of power.

#### *Available Sites.*

The two available sites on the river best suited to the requirements of the town are Cataract Falls and White Falls, six and seven miles respectively from the town. The site at Cataract Falls has the advantage of being probably a mile nearer the town and has also good facilities for peak load storage, as it is just at the foot of Cataract Lake. The natural head is about 23 feet.

At the White Falls site, while the facilities for peak load storage are not remarkable, there is a natural head of 55 feet, which more than offsets this disadvantage as compared with Cataract Falls. Moreover the topographical features of the White Falls site are such as to allow of easy development. The site can be reached conveniently in the winter by means of the winter road and in summer a tug of 8-foot draught can deliver material within a mile and a half of the power site. This will influence the construction costs very materially.

#### *Power Capacity.*

At the time of inspection the discharge at the White Falls was sufficient to produce about 9.5 continuous 24-hour horse power per foot of head. The river on this occasion was said to be at its lowest stage, but owing to the fact that the discharge of the river and the storage of the upper lakes is controlled by a Slide and Boom Company, it is not at all certain that water sufficient to produce this amount of power will be available the year round, over and above the quantity required for driving purposes. This point will require further investigation during the summer while driving operations are in progress, but in the meantime it has been agreed to submit an estimate based on the capacity of the site as determined at the time of inspection.

#### *Development.*

The natural head at White Falls could be increased to 65 feet by the construction of suitable headworks at the crest of the fall, and assuming, as above stated, a capacity of 9.5 horse power per foot of head, the full development would produce 620 horse power at the turbine shaft.

As the existing market is small, an estimate based on the present demand would force the annual cost of power beyond commercial limits. Two estimates will therefore be submitted, one based on the assumed delivery of full capacity, all losses being deducted, and the other based on the delivery of half capacity under similar conditions.

The capital cost in the first estimate includes the construction cost of permanent works, cost of hydraulic and electrical equipment, transmission line and step-down transformation, all for full capacity; also a percentage for contingencies and interest during construction. Annual charges include depreciation and maintenance, interest on capital investment and operation and administration.

The second estimate provides permanent works and transmission line for full capacity, but hydraulic, electric and sub-station equipment for half capacity only. Otherwise this estimate is figured along the same basis as the first. No spare generating equipment is provided for in either case.

While this report is only of an advisory nature, it is based upon information which is sufficiently reliable to give a safe estimate of the possibilities, should the municipality see fit to take definite action with regard to development.

#### ESTIMATE No. 1.

Provides for the net delivery in Blind River of 550 H.P.

##### *Capital Investment.*

Permanent works .....	\$18,500 00
Excavation and false work .....	7,000 00
Hydraulic equipment .....	9,050 00
Electrical equipment .....	11,550 00
Transmission equipment .....	12,270 00
Step-down transformation .....	11,730 00
	<hr/>
	\$70,100 00
Engineering and contingencies, 10% .....	7,010 00
Interest during construction, 2½% .....	1,927 00
	<hr/>
Total capital investment .....	\$79,037 00

Cost of 1 H.P. to build on basis of 550 H.P. delivered, \$144.00.

##### *Annual Charges.*

Permanent works .....	\$355 00
Hydraulic equipment .....	500 00
Electrical equipment .....	654 00
Transmission equipment .....	772 00
Step-down transformation .....	560 00
Annual interest on \$82,000 at 4½% .....	3,690 00
Operation and administration .....	5,500 00
	<hr/>
Total annual charges .....	\$12,031 00

Total annual cost of 1 H.P. at low tension busbars (220 volts) of Blind River sub-station on basis of 550 H.P. delivered, \$21.80.

## ESTIMATE No. 2.

Provides for the net delivery in Blind River of 280 H.P.

*Capital Investment.*

Permanent works .....	\$17,800 00
Excavation and false work .....	7,000 00
Hydraulic equipment .....	5,550 00
Electrical equipment .....	6,600 00
Transmission equipment .....	8,900 00
Step-down transformation .....	8,655 00
	<hr/>
Engineering and contingencies, 10% .....	\$54,505 00
Interest during construction, 2½% .....	5,450 00
	1,498 00
	<hr/>
Total capital investment .....	\$61,453 00

Cost of 1 H.P. to build on basis of 280 H.P. delivered, \$219.00.

*Annual Charges.*

Permanent works .....	\$348 00
Hydraulic equipment .....	315 00
Electrical equipment .....	473 00
Transmission equipment .....	577 00
Step-down transformation .....	380 00
Annual interest on \$61,500 at 4½% .....	2,770 00
Operation and administration .....	3,500 00
	<hr/>
	\$8,363 00

Total annual cost of 1 H.P. at low tension busbars (220 volts) of Blind River substation on basis of 280 H.P. delivered, \$29.90.

## SAULT STE. MARIE POWER DEVELOPMENT AT WHITEFISH ISLAND.

This report is submitted in accordance with the request of the municipality of Sault Ste. Marie, and deals with the possibility of developing the water power of the Whitefish Channel for the municipal needs of Steelton and the Canadian Soo.

The proposed site for development is located on a side channel between Whitefish Island and the main land, and was partially developed by Ryan & Haney for construction purposes during the building of the Canadian lock. The head-works built by them are still in existence, and as they are built upon the most favorable site, a portion could be utilized for the projected new development.

In view of the market possibilities in these two municipalities, it would be very poor policy to install permanent works for anything less than the maximum power capacity of the site, and this would entail the construction of a dam capable of handling the discharge of the channel under maximum conditions of flow. To accomplish this, the present dam should be torn out and replaced by one of concrete construction, and if deemed necessary or advisable the existing corewalls on either side of the channel could be raised or lengthened to meet new conditions. No detailed surveys of this site are at present available, upon which to base an estimate for the cost of development. The reliability of such an estimate would, in any case, be largely discounted, owing to uncertainty with regard to the



available supply of water, and while the topographical features of the site are sufficiently favorable, the main point is to devise a method by means of which the natural flow of the Whitefish Channel may be restored and maintained.

In the Lake Superior Power Company's Charter is a clause designed to hold them responsible to both Federal Governments for the level of the water in the locks, which must at all times be held at or above a certain specified elevation. There are at present five channels through which the waters of Lake Superior can discharge, namely: The natural channel of St. Mary River, the American lock, the Canadian lock, the American Power Canal and the Canadian Power Canal. It is evident that when these channels are discharging freely, a large quantity of water in excess of the natural discharge is being drawn from Lake Superior, with a consequent reduction of water level in the locks. For this reason, the American authorities during the past winter, ordered half the wheels in the American plant to be shut down, at a loss to the company said to be in the neighborhood of \$8,000 per month. If these plants are to be kept operating at full load without detriment to the navigation interests, the free discharge of the main channel must be curtailed in such a manner as to compensate for the water drawn from Lake Superior by the artificial channels which feed the power plants. With this object in view, the construction of a compensating wing-dam has been commenced on the Canadian shore about 200 feet above the railway bridge. The two channels between the small islands have been blocked by the railway embankment, and the permanent works of the wing-dam extend from the extremity of this fill.

The permanent work as completed to date consists only of three sluice-ways with masonry wing-walls and piers, but there is no doubt that the experience of last winter will cause the Company to push on the extension of this dam with all possible speed.

In this connection it is important to note the effect the extension of this dam will have on the flow of water through the Whitefish Channel.

It will be seen from the plan that a large portion of the natural supply for this channel has been cut off by the railway embankment, and also that the wing-dam as it exists at present has a tendency to form back-water at the head of the channel. It is evident that the more the wing-dam is extended the more pronounced will become this back-water action, until ultimately the channel will become practically useless for power purposes, unless some remedial action is taken.

To preserve this channel it will be necessary either to reopen the old channel through the C.P.R. embankment, or to make arrangements with the Lake Superior Corporation whereby a continuous discharge, sufficient to restore the natural flow in the Whitefish Channel, will be drawn from the wing-dam sluices. Once this is done the minimum power capacity of the channel could be augmented, at the option of the municipalities, by throwing out a gathering-dam from the head of the island as indicated on the plan.

It is important to note that the foregoing has been based upon the assumption that the municipalities will be able to procure by lease or purchase, sufficient land on either side of the channel for the establishment of the permanent works. The property which it would be necessary to procure is substantially as indicated on the plan, namely, the strip of Crown Lands on the main shore and enough of Whitefish Island to allow the placing of the dam abutment and wing-wall.

A certain amount of flooding along the island shore will be unavoidable, even in the case of partial development, so that it will be necessary to acquire riparian privileges along the entire inner shore of the island.

Any scheme to develop power on this site independent of the Whitefish Island property and the riparian rights connected therewith, does not appear commercially feasible; first, because the amount of power obtained would be inadequate, and second, on account of the largely augmented capital expenditure which would be necessary in order to divert any portion of the channel's flow without injury or interference in connection with the said island.

To sum up, nothing but the full power capacity of the site could be safely considered as sufficient to supply the present and probable future municipal requirements of Sault Ste. Marie and Steelton, and if it is possible to acquire reasonably, by purchase or otherwise, the necessary property on both sides of the channel, the development for full capacity, as described above, is strongly to be recommended. In any case, it would be impossible to develop power on this site in any way or in any quantity without raising or lowering the water along the inner shore of the island, thus coming into conflict with interests controlling it.

The situation with regard to development rights on the property appears rather complicated. Whitefish Island, which belonged originally to the Dominion Government, is now held under patent by the Algoma Central Railway, the alleged intention being to establish a railway terminal thereon. In this event, it is highly probable that an earth fill will be carried across the head of the channel between the mainland and the upper end of the island, leaving the channel dry.

With regard to claims against this property, it should be noted that in the year 1900 an arbitration took place between the late Government and Messrs. Ryan & Haney to fix the value of the improvements made upon the power site by this firm. The value was fixed at \$24,031.24, and the intention of the Government was that any purchaser of this power should be compelled to pay this sum to Ryan & Haney, the power being, therefore, practically mortgaged to this extent. The legal points of the case are not properly within the scope of this report and the above information is included simply to make the general aspect of the case clearer, and before any further steps are taken in connection with the hydraulic features of the problem, the validity of the Ryan & Haney claim, and the extent to which the municipalities would become involved with the Algoma Central interests in the event of development, should be thoroughly investigated.

For this purpose it would be advisable to obtain information on the following points:

(1) The waters of the St. Marys River, a navigable international stream, being under Federal control, are the waters of the Whitefish Canal, a subsidiary channel, also under Federal control. In other words, does the natural bed of the St. Marys River extend from mainland to mainland, Whitefish Island being simply an island in the bed of main stream, the water surrounding it being all under Federal control?

(2) If the waters of the Whitefish Channel, as a subsidiary channel, are not under Federal control, what are the legal rights of the riparian owners, viz., the Province of Ontario and the Algoma Central Railway?

To conclude, if by any reasonable means a clear title to the property may be acquired, and if the necessary steps can be taken to insure a permanent natural flow in the channel, the proposition is one which the municipalities can handle with safety and profit.

August 20th, 1908.

## ALMONTE, RE POWER FOR MUNICIPALITY.

*Source of Power.*

The source of power available for Almonte is the Mississippi River, which divides into two main channels, within the corporation limits. The right channel is developed to its full capacity by the Almonte Woollen Mills Co., and the left channel, which carries the larger portion of the flow, is only partially developed, heads of from 8 to 25 feet being utilized at the head and foot of the main fall. The municipal lighting plant is located at the head of the fall, operating at 25-foot head.

*Local Conditions.*

The natural topographical conditions in the neighborhood of the power site are such as to make possible the development of the full natural head, and the utilization of the full flow of the river in an efficient and economical manner, but unfortunately, these conditions are discounted by reason of individual water privileges which have been developed for comparatively small heads. The wooden dam at the head of the falls, though covered with ice and snow at the time of inspection, appeared to be in a very dilapidated condition and is doubtless responsible for a serious waste through leakage, during periods of low water. All things considered, the proper course would undoubtedly be for the town to take over the individual privileges at present existing, develop the power to its full capacity with new equipment throughout, and return to the owners the electrical equivalent of the power they are at present using, at a cost which would not exceed their present annual charges. Owing to the higher efficiency of a central plant the town would be able to supply the required amount of power to these customers with a much smaller amount of hydraulic energy than they are themselves using at the present time.

*Natural Characteristics.*

The natural discharge of the Mississippi River at Almonte is estimated to be not less than 300 second feet during periods of low water. Natural conditions at the head-waters of the river are such as to afford good facilities for artificial storage. The present low water flow could probably be increased 75 per cent. by placing dams at the outlets of some of the larger lakes, and the future will doubtless see some action taken along this line. This report, however, will deal only with conditions as they are, both as regards the natural characteristics of the river and in connection with available sites for the development of power.

*Municipal Development, Existing and Proposed.*

At present the town of Almonte operates a small plant at the head of the falls, the average head being about 25 feet. This plant has a rated electrical capacity of 175 kilowatts, but owing to the poor arrangement of the plant, and the inefficient installation of the hydraulic equipment, the maximum load obtainable on the switchboard does not exceed 125 kilowatts, this output being entirely inadequate to meet the maximum requirements of the connected load. If the present plant were capable of operating to the limit of its rated capacity, it could, no doubt, hold the present load without trouble, but there would be little or no capacity on reserve for a future increase.



Leaving out of consideration altogether the supply of power for manufacturing purposes, a town of Almonte's class should quite reasonably have 300 kilowatts of installed electrical capacity (for which 500 hydraulic horse power would be required) available for lighting and pumping service. It is to be noted also that this statement makes no allowance for any marked increase in population or industrial activity.

#### *Available Power Sites.*

In addition to the site of the present plant the town has an opportunity to purchase two other locations in the immediate vicinity. One location would admit of a power house being placed about 200 feet down stream from the present plant, and on the same side of the stream. The power house in this case would be placed just below the present stone highway bridge and the water would be carried to the penstocks through a canal or covered flume from the intake of the present plant.

In the second case the power house would be located on the other side of the stream, and within reach of the lower tail-water basin, locally known as Grenville's Bay, the full natural head being thus utilized. To carry water to the wheels it will be necessary to construct a canal or flume, somewhat longer than in the previous case, from the intake of the present plant to a point about 100 feet below the highway bridge. From this point it will be necessary to carry a penstock across the stream on a single concrete arch span to reach the wheels. If an open canal is used, it will probably be necessary in both cases to line it throughout with concrete, owing to the seamy nature of the rock.

#### *Comparison of Capacities.*

The following statements are based on the assumption that the low-water discharge of the river is confined to the left channel of the river. This being the case, and assuming also that the town is entitled to half the water, there will be a discharge of 150 second feet available for municipal purposes during the low-water period. This is equivalent to 13.6 horse power, continuous power per foot of head at the turbine shaft.

The proposed installation at the bridge would allow the use of 30 feet natural head. The plant would then have a capacity of 400 hydraulic horse power. It would thus appear that this plant would not have sufficient capacity to meet the ultimate municipal demand, as estimated, though it would probably be sufficient for some time to come.

The second scheme involves the utilization of the full natural head, the average value of which may be safely taken at 50 feet. A plant operating under this head would produce about 680 hydraulic horse power. Under existing conditions this is the maximum amount of power available for the municipality at estimated low water.

#### *Estimates.*

In accordance with the wishes of the Light Commissioners, two estimates have been prepared, one for each of the schemes above described. An effort has been made in these estimates to keep the capital investment within limits laid down by the Commissioners, and while either scheme is quite feasible, both structurally and commercially, it should be pointed out that they are not entirely in accordance with the ideas of the Power Commissioners' Engineer, considering the problem from an engineering standpoint. (See section 2 of this report.)

The plants estimated on have provision made in both cases for the ultimate installation of up-to-date alternating-current equipment, but for the present it is assumed that the direct-current equipment in the present power house will be used. This will result in a temporary saving, not only as regards the actual equipment, but in connection with the distribution system, which would require re-arrangement to accommodate alternating current. On the other hand, the plant under these conditions, will operate at a much reduced efficiency, as compared with that of new and up-to-date equipment, and there will be a much greater liability to interruption of service. It has also been necessary to allow considerably more power-house space for the belted machinery than would be necessary for direct connected units. For this reason the power houses in both estimates have permanent foundations only, the superstructures being built of wood in each case.

The estimate for the 30-foot head provides for the installation of one 400 horse power wheel to be ultimately connected to one 250 kilowatt three phase 60 cycle generator. The estimate for 50-foot head provides for a canal, penstock and power house for the full capacity of 680 horse power, and for the preliminary installation of one 350 horse power wheel, to be ultimately direct connected to a 200 kilowatt three phase 60 cycle generator. As before stated both estimates provide belts and shafting for the temporary connection of the present direct-current equipment, which consists of two 30 kilowatt Edison Type, and two 55 kilowatt Canadian General generators of later design.

In conclusion, it should be distinctly understood that these estimates are not working estimates, the function of the report as a whole being purely advisory, and before any definite policy is decided upon, the services of a competent engineer should be secured to make detailed surveys. An estimate based on these surveys will then fully indicate whether or not the project is one which the municipality can handle with safety and profit.

#### ESTIMATE No. 1.

Head .....	30 ft.
Minimum capacity, 24 hr. power .....	400 H.P.
Installed hydraulic capacity .....	400 H.P.
Ultimate electrical capacity .....	250 K.W.
Present electrical capacity .....	175 K.W.
Output at switchboard, assuming 85% efficiency of old apparatus—149 K.W.	200 H.P.

Provides for concrete lined canal with stop-log gate at each end, concrete turbine and draft-tube chamber and bulkhead; concrete power house foundations with wooden superstructure and hand regulated hydraulic equipment necessary for the generation of 400 horse power. Allowance also made for all temporary work and installation of old machinery.

#### Capital Costs.

Mechanical equipment .....	\$3,300 00
Head works .....	5,400 00
Power House, including foundations and turbine setting .....	2,600 00
Excavation for same .....	1,350 00
Cost of privilege .....	1,000 00
	<hr/>
	\$13,650 00
Engineering and contingencies, 10% .....	1,365 00
	<hr/>
Total .....	\$15,000 00

*Annual Charges.*

Mechanical equipment .....	\$150 00
Incidental repairs on electrical equipment .....	200 00
Power House and permanent works .....	138 00
	<hr/>
Engineering and contingencies, 10% .....	\$488 00
Interest on \$15,000 at 5% .....	49 00
Operation and administration .....	750 00
	<hr/>
Total annual charges .....	\$2,500 00
	<hr/>
	\$3,787 00

## ESTIMATE No. 2.

Head .....	50 ft.
Minimum capacity, 24-hr. power .....	680 H.P.
Present hydraulic capacity to be installed .....	350 H.P.
Future electrical preliminary capacity .....	200 K.W.
Present electrical capacity installed .....	175 K.W.
Output at switchboard, assuming 85% efficiency of old apparatus—149 K.W.	200 H.P.

Provides for concrete lined canal, and penstock for full ultimate capacity. Complete hand-regulated hydraulic equipment for initial capacity of 350 H.P.; concrete power house foundations with wooden superstructure, and allowance for improving tail race, temporary work and installation of old machinery.

*Capital Costs.*

Mechanical equipment .....	\$2,500 00
Head works .....	6,900 00
Power House, including foundations .....	3,760 00
Penstock, setting and accessories .....	6,000 00
Excavation and improvement of site .....	1,000 00
Cost of privilege .....	5,500 00
	<hr/>
	\$25,660 00
Engineering and contingencies, 10% .....	2,566 00
	<hr/>
	\$28,226 00

*Annual Charges.*

Mechanical equipment .....	\$110 00
Incidental repairs on electrical equipment .....	200 00
Power House, penstock and permanent works .....	310 00
	<hr/>
	\$620 00
Engineering and contingencies, 10% .....	62 00
Interest on \$28,500 at 5% .....	1,425 00
Operation and administration .....	2,550 00
	<hr/>
	\$4,657 00

## SUMMARY.

*Estimate No. 1.*

Estimated capital cost, \$15,000.
“ annual charges, \$3,800.
“ cap. cost based on capacity of 250 K.W., \$68.00 per H.P.
“ “ “ “ “ 149 “ 75.00 “ “
“ annual cost based on “ “ 250 “ 12.00 “ “
“ “ “ “ “ 149 “ 19.00 “ “

*Estimate No. 2.*

Estimated capital cost, \$28,500.
“ annual charges, \$4,600.
“ cap. cost based on initial capacity of 200 K.W., \$125.00 per H.P.
“ “ “ “ “ 149 “ 142.00 “ “
“ annual cost based on “ “ “ 200 “ 17.50 “ “



NOTE.—Neither estimate takes into consideration the construction of a new dam at the head of the falls. Owing to the leaky nature of the present structure it is possible that the low-water flow of the river may not suffice to divert 150 sec. ft. into the intake of the municipal plant after leakage has been allowed for. The cost of a new dam would, of course, be borne by the interests operating on that level.

TORONTO, Jan. 15th, 1908.

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PETERBORO.

In accordance with a resolution passed by the Council of the city of Peterboro, presented herewith, is a report concerning the question of an additional supply of power for the city of Peterboro from Ottonabee River.

After careful investigation, Burleigh Falls is recommended as the most feasible development for the needs of Peterboro. All available sites were considered, but Burleigh Falls is without doubt best suited for the needs of this city.

The question resolves itself into the consideration of two power sites, viz., Burleigh Falls, 22 miles from Peterboro, and Auburn Mills, on the outskirts of the town. The other locations examined were not sufficiently important to warrant discussion.

*Water Supply.*

Taking into account the effect of the locks and regulating dams of the Trent Valley Canal System, it would be very safe to assume the flow at Burleigh Falls as equivalent to 95 horse power per foot of head under minimum conditions. At Auburn the minimum flow would be so increased to make 100 horse power per foot of head a safe estimate. The location at Auburn would also have the advantage of the storage facilities at Jack's Lake, which is said to have an area equal to that of Stoney Lake, and could be raised ten feet above its natural level at comparatively small expense. At the present speaking, Burleigh Falls has a great advantage over the Auburn site in that the storage facilities of Lovesick Lake afford greater scope for load factor accommodation than will ever be possible at Auburn, but it is important to note that in the event of through navigation on the Trent Valley Canal being established, the power interests will be subservient to those of navigation through open season. This being the case, the power interests would be limited to the natural flow of the river as controlled and influenced by the operation of the canal. Consequently, although sufficient water could be drawn off Lovesick Lake to satisfy daily peak load demands without material change in its normal level, the same thing could be done at Auburn with the aid of the waterworks dam. Under the above conditions, both locations would be on a par as regards regulation, while the Auburn site would have the advantage of a larger drainage area, including the storage possibilities of Jack's Lake.

*Available Head.*

The present head at the Auburn dam is about 13 feet. By increasing the tail-water conditions, this could probably be increased to about 16 feet. The crest of the dam could be raised at least three feet without excessive land damages, as the length of the dam would allow of sufficient sluice and spill-way discharge area to take care of flood water. The fact that it would be necessary to keep the head-water level constant would result in a reduction of head during periods of high water. During the spring floods this would be a serious disadvantage, to obviate which it would be necessary to install reserve turbine capacity in the power house.

It is to be noted that of the 19 feet obtainable as described above, 3 feet will be gained at the expense of the waterworks dam, which is half a mile up stream.

At Burleigh the normal head will be about 22 feet, with a possibility of its being increased to 26 feet. This is due to the fact that in the event of through navigation for vessels of 9 feet draught being established on the Trent Valley Canal, the lock sills at Burleigh will be lowered, and at the same time the water level in Lovesick Lake will be raised about 4 feet to the level of Deer Bay, thus drowning out Lovesick Lock. Owing to the large amount of work to be done on the canal between Trenton and Peterboro, nothing will be done at Burleigh for at least four years, so that at present 22 feet only can be counted upon. The head at this location will be comparatively constant owing to the canal regulation, having in this an advantage over the Auburn site.

### *Topographical Conditions.*

The topographical conditions at Auburn are most unfavorable, mainly on account of the width of the channel and the low shores. Owing to these conditions, the construction costs and land damages which would be entailed by the creation of a head equal to that at Burleigh would be unreasonably large in view of the capacity of the plant. Furthermore, any increase in the height of the Auburn dam would result in either the total or partial elimination of the head at the waterworks dam. The head at the waterworks property being not more than 10 feet, anything short of the complete drowning out of the dam would appear to be poor policy, as it would result in the ruin of the property as a commercial proposition.

For the reasons above mentioned it is highly probable that the Auburn property could best be handled by developing for a head of 15 feet and ultimately developing the waterworks property to full capacity, the two plants to be run in parallel. Under these conditions, against the additional administration charges due to the operation of two separate plants, could be placed the annual charge on the excessive investment necessary to cover the land damages which would result from combining the two heads at Auburn.

At Burleigh Falls the changing or adapting of topographical conditions is primarily in the hands of the canal authorities. The conditions at present existing at Burleigh are such as to make the capital cost of development per horse power lower than the average, and further changes contemplated by the canal authorities will tend to make conditions still more favorable for the power interest. At Burleigh the item of land damages will be entirely eliminated and the capital costs of permanent works substantially less than at Auburn.

### *Titles.*

The property at Auburn is held under a deed and a clear title can be obtained by purchase. The property and privileges at Burleigh are privately held under two leases, one of which was granted by the Dominion and the other by the Provincial Government. It seems clear from the conditions contained in it that the Provincial lease is forfeited, but the conditions of the Dominion lease are of such a general and indefinite nature that there is considerable uncertainty as to what right the lessee holds under it. In this connection it seems advisable to get information on the following points:—

1. Has the Dominion Government any right to, or control of, surplus water after the purposes of navigation have been satisfied, except where it has purchased

property rights? Otherwise, is the surplus water not the property of the Provincial Government?

2. Are the rights and privileges of a lessee from the Dominion Government of such a nature as to be subject to expropriation proceedings under a Statute of the Provincial Legislature?

If these questions can be cleared up and the Burleigh site purchased under reasonable conditions, or otherwise acquired, there seems to be no doubt, all things being considered, that this site is better adapted to the needs of the city of Peterboro than any other location on the river, Auburn included. In the event of the city's demand ultimately exceeding the capacity of the Burleigh plant, the full capacity of the waterworks dam could be developed and the two operated in parallel. With these two plants to draw on, the city would be safe in overselling the installed capacity by a considerable amount.

The estimate submitted herewith is for the development of the full capacity of the Burleigh site under present conditions, with provision for efficient operation under a definite increment of head. The estimate includes the capital charges for development, step-up transformation, transmission, step-down transformation at Peterboro, engineering contingencies, and interest during investment, maintenance and depreciation, operation and lost power.

In conclusion it must be understood that the function of this report is purely advisory, and that before any definite action is taken towards development, a detailed survey should be made of any site that may be ultimately chosen, from which plans and estimates may be prepared, which will show whether or not the project is one which the municipality can handle with safety and profit.

Estimate based on the development of full capacity of Burleigh Falls under 22-foot head, and a net delivery of 1,850 horse power at Peterboro, permanent works being constructed for operation under an ultimate head of 26 feet and a net delivery of 2,150 horse power at Peterboro.

*Capital Cost.*

Dam and head works and foundation .....	\$34,000 00
Power House and Transformer Station .....	20,000 00
Hydraulic equipment .....	26,000 00
Electrical equipment .....	40,000 00
Step-up transformation .....	36,500 00
Transmission (single line) .....	38,000 00
Step-down transformation .....	36,000 00
Miscellaneous .....	5,900 00
	<hr/>
Engineering and contingencies, 10% .....	\$236,400 00
Interest during construction, 3% .....	23,640 00
	<hr/>
Total capital investment .....	\$267,841 00

Cost of 1 H.P. to build, transmit and transform on basis of 1,850 H.P. delivered, \$145.00.

*Capital Charges.*

Generation .....	\$4,600 00
Step-up transformation .....	1,800 00
Transmission .....	2,375 00
Step-down transformation .....	1,730 00
Engineering and contingencies, 12% .....	1,260 00
Annual interest on \$268,000 at 4½% .....	12,050 00
Operation and administration .....	10,000 00
	<hr/>
Total capital charges .....	\$33,815 00

Total annual cost of 1 H.P. at low tension busbars of Peterboro sub-station on basis of 1,850 H.P. delivered, \$18.30.



## BRUCE MINES, POWER FOR MUNICIPALITY.

*Power Requirements.*

The existing market in the municipality is insignificant, and the object of the investigation was to determine the amount of power available to the municipality which could be offered as an inducement for the establishment of industries.

*Available Power.*

The main source of power upon which this municipality is dependent is the Mississauga River. The Thessalon River is much nearer to the town, but as a source of power is not worth considering from an industrial standpoint. At Milltown, about 7 miles from Bruce Mines, is a small power that would serve the town's municipal and residential requirements for some time to come, but the development cost would be high in proportion to the output of the plant, and as a source of power for industrial purposes it is quite inadequate.

On the Mississauga River, however, some very good power locations exist, and the low water flow of the river is sufficient to develop some fairly large blocks of power. In so far as the town of Bruce Mines is concerned, the great drawback in connection with development on the Mississauga is the transmission distance, the nearest available site being 26 miles from Bruce Mines.

*Available Power Sites.*

On this river, the site best suited to the requirements of the municipality is undoubtedly Slate Falls, but it appears that this property is held privately under a deed and is not in the market. An estimate for Slate Falls is contained in the Fifth Report of the Hydro-Electric Power Commission.

Leaving Slate Falls out of consideration, the most favorable site is that at Squaw Chute, and an estimate for the development of this property is included in this report.

*Minimum Capacity.*

Taking the figures given in the Fifth Report of the Hydro-Electric Power Commission, this portion of the river will discharge 850 second feet under conditions of minimum flow, this being equivalent to approximately 77.5 horse power minimum 24-hour power per foot of head, without storage.

The natural head at the chute is about 17 feet, but the estimate is based on the possibility of increasing this to 25 feet, the topographical features of the locality being such as to make this assumption reasonable. According to the above estimates of discharge the minimum power capacity of this location under a head of 25 feet will be 1,930 horse power continuous 24-hour power at the turbine shaft.

The dam construction necessary in connection with this development will create a storage basin above the works, which, while not having sufficient to appreciably augment the natural flow of the river at low stages, will nevertheless be exceedingly useful as regards load factor accommodation, the extra water impounded being used to carry the plant over the period when the daily simultaneous demand of all customers reaches the maximum value. For this reason it would be safe to oversell the maximum capacity of the plant (1,930 horse power) from ten to possibly twenty-five per cent., this percentage depending upon the number of hours per day of service called for in the contracts with the various customers.

*Development.*

The proposed scheme of development will involve the construction of an overflow dam in the main channel, a power house with headworks in the central channel and either a spillway or core-wall at the head of the outer high-water channel. The entrance of the central channel should also be provided with an ice-boom or ice racks.

The cost of construction is based on the possibility of delivering construction material at Rock Lake by rail, and a thirteen-mile team haul from this point to the power site. The long haul will of course materially increase the cost of construction.

Any attempt to submit an estimate with prices based on the present power demand in the municipality would force the price of delivered power beyond reasonable limits. The capital and annual costs per horse power have therefore been calculated on the assumed delivery in Bruce Mines, first, of full capacity, and, secondly, of half capacity, all losses being deducted in each case, and the price based on the actual quantities of power delivered.

It will, of course, be recognized that the function of this report is purely advisory, and while it gives a fairly accurate and wholly conservative indication of the possibilities, no definite action should be taken in connection with development until a detailed survey of the property has been made. This survey will serve as a basis for estimates which will show definitely whether or not the project can be handled by the municipality with safety and profit.

## ESTIMATE No. 1.

Provides for the net delivery in Bruce Mines of 1,750 H.P.

*Capital Investment.*

Dam, head works and Power House .....	\$31,450 00
Excavation and false work .....	15,500 00
Hydraulic equipment .....	28,000 00
Electric equipment .....	41,920 00
Step-up transformation .....	33,740 00
Transmission .....	52,000 00
Step-down transformation .....	41,900 00
	<hr/>
	\$244,510 00
Engineering and contingencies, 10% .....	24,451 00
Interest during construction, 3% .....	8,069 00
	<hr/>
Total capital investment .....	\$277,030 00

Cost of 1 H.P. to build on basis of 1,750 H.P. delivered, \$158.00.

## ESTIMATE No. 1.

*Annual Charges.*

Dam, head works and Power House .....	\$693 00
Hydraulic equipment .....	1,410 00
Electric equipment .....	2,467 00
Step-up transformation .....	1,734 00
Transmission .....	3,554 00
Step-down transformation .....	2,129 00
Engineering and contingencies, 10% .....	1,200 00
Annual interest on \$277,000 at 4½% .....	12,500 00
Operation .....	7,200 00
	<hr/>
Total annual charges .....	\$32,887 00

Total annual cost of 1 H.P. at low tension busbars of Bruce Mines sub-station on basis of 1,750 H.P. delivered, \$18.80.

## ESTIMATE No. 2.

Provides for the net delivery in Bruce Mines of 880 H.P.

*Capital Investment.*

Dam, head works and Power House .....	\$31,450 00
Excavation and false work .....	15,500 00
Hydraulic equipment .....	16,200 00
Electric equipment .....	23,380 00
Step-up transformation .....	20,670 00
Transmission .....	33,770 00
Step-down transformation .....	26,600 00
	<hr/>
	\$167,570 00
Engineering and contingencies, 10% .....	16,757 00
Interest during construction, 3% .....	5,530 00
	<hr/>
Total capital investment .....	\$189,857 00

Cost per H.P. to build on basis of 880 H.P. delivered, \$215.00.

## ESTIMATE No. 2.

*Annual Charges.*

Dam, head works and Power House .....	\$629 00
Hydraulic equipment .....	854 00
Electric equipment .....	1,294 00
Step-up transformation .....	1,003 00
Transmission .....	2,476 00
Step-down transformation .....	1,263 00
Engineering and contingencies, 10% .....	750 00
Annual interest on \$190,000 at 4½% .....	8,550 00
Operation .....	5,700 00
	<hr/>
Total annual charges .....	\$22,519 00

Total annual cost of 1 H.P. at low tension busbars of Bruce Mines sub-station on basis of 880 H.P. delivered, \$25.60.

## NORTH BAY, RE POWER SUPPLY FROM SMOKY FALLS.

*Power Requirements.*

The market at present existing in this municipality approximates 1,200 horse power, and the object of this report is to determine the probable capital investment and annual expenditure necessary to insure the delivery in North Bay of certain blocks of power, as specified hereunder.

*Source of Power.*

The source of power to be considered is the Sturgeon River. This river, which has a watershed area of 2,300 square miles, drains about half of that portion of the Nipissing District lying to the south and west of Lake Temagami. At the present time, the natural characteristics of this river are such as to make it favorable for power purposes. The comparative uniformity of flow which mainly distinguishes it at present will, of course, suffer in course of time from the extensive lumbering operations carried on pretty generally throughout the watershed, and artificial means must eventually be employed to maintain present conditions. The municipality of North Bay would, however, be able to obtain an ample power supply from this river for some time to come, under natural conditions.



*Power Sites.*

Owing to the transmission distance, it is necessary that the site for development should have as many natural advantages as possible, the most important being a good natural head.

Of the undeveloped locations upon the river, the one which best fulfils these conditions is that known as Smoky Falls, and the estimates following have been prepared in connection with the development of this site, and the transmission of the power to North Bay.

*Power Capacity.*

Under conditions of average flow, the Sturgeon River would produce 100 horse power continuous 24-hour power per foot of head.

The investigations of the Hydro-Electric Power Commission indicate, however, that 77 horse power continuous power per foot of head is all that can be depended upon under minimum conditions of flow. This being the case, and assuming the possibility of obtaining a head of 30 feet, the minimum capacity of this site will be slightly less than 2,500 horse power continuous 24-hour power.

The following estimates will be based upon the possibility of generating 2,500 horse power at full load, with a half-load capacity of 1,250 horse power.

*Development.*

The natural head of Smoky Falls is 28 feet and the permanent works necessary in connection with development will create at least two feet additional head, making 30 feet in all. Being a twin fall, the question of unwatering will be greatly simplified, as will also the disposal of flood water during construction, and when operation has begun.

The scheme of development will involve the construction of a dam at the head of each channel, the longer one across the left channel to serve for regulation and overflow, and the shorter one across the right channel to contain the head-works necessary to control and regulate the supply of water to the wheels.

The topographical features of the power site are as a whole favorable, and the scheme of development will be comparatively simple. The great disadvantage of the site is its inaccessibility, and the ten-mile team haul which will be necessary to deliver material will increase the construction costs considerably.

The estimate for full capacity presented herewith, includes the capital cost of permanent works, hydraulic and electrical equipment, transmission and transformation, and an allowance for engineering and contingencies and interest during construction. The estimate of annual charges for full capacity includes depreciation and maintenance on hydro-electric equipment, permanent works and transmission line, also interest on investment, and an allowance for operation and administration.

The estimate for half capacity will provide permanent works for full capacity, but hydraulic, electric and transmission capacity for half load only. Otherwise the half load estimate will be figured on the same basis as that for full load.

As indicated in the estimates the prices for power are for low tension power delivered at the municipal sub-station, but not distributed therefrom, and in conclusion it should be noted that this estimate, while very safe and liberal, is of an advisory nature, and before any definite steps are taken toward development, a detailed survey of the power site and a reconnaissance survey of the transmission route should be made, in order to obtain the data necessary for a closer estimate.

## ESTIMATE No. 1.

Provides for the delivery in North Bay of 2,500 H.P.

*Capital Investment.*

Dam, head works and Power House .....	\$20,300 00
Excavation and false work .....	13,200 00
Hydraulic equipment .....	36,550 00
Electrical equipment .....	51,400 00
Step-up transformation .....	27,450 00
Transmission .....	47,800 00
Step-down transformation .....	38,730 00
	<hr/>
	\$235,530 00
Engineering and contingencies, 10% .....	23,553 00
Interest during construction, 3% .....	7,066 00
	<hr/>
Total capital investment .....	\$266,149 00

Cost of 1 H.P. to build on basis of 2,500 H.P. delivered, \$106.00.

## ESTIMATE No. 1.

*Annual Charges.*

Dam, head works and Power House .....	\$338 00
Hydraulic equipment .....	1,706 00
Electrical equipment .....	3,001 00
Step-up transformation .....	1,560 00
Transmission .....	3,150 00
Step-down transformation .....	2,110 00
Engineering and contingencies, 10% .....	1,186 00
Annual interest on \$266,200 at 5% .....	13,310 00
Operation and administration .....	7,000 00
Thirty years' sinking fund at 5%—1.51% .....	4,019 00
	<hr/>
Total annual charges .....	\$37,380 00

Total annual cost of 1 H.P. at low tension busbars of North Bay sub-station on basis of 2,500 H.P. delivered, \$14.95.

August 12, 1908.

## ESTIMATE No. 2.

Provides for the delivery in North Bay of 1,200 H.P.

*Capital Investment.*

Dam, head works and Power House .....	\$18,300 00
Excavation and false work .....	13,200 00
Hydraulic equipment .....	21,400 00
Electrical equipment .....	27,450 00
Step-up transformation .....	16,200 00
Transmission .....	29,600 00
Step-down transformation .....	24,000 00
	<hr/>
	\$150,150 00
Engineering and contingencies, 10% .....	15,015 00
Interest during construction, 3% .....	4,503 00
	<hr/>
Total capital investment .....	\$169,668 00

Cost of 1 H.P. to build on basis of 1,200 H.P. delivered, \$142.00.

ESTIMATE No. 2.

*Annual Charges.*

Dam, head works and Power House .....	\$318 00
Hydraulic equipment .....	932 00
Electrical equipment .....	1,606 00
Step-up transformation .....	901 00
Transmission .....	2,100 00
Step-down transformation .....	1,256 00
Engineering and contingencies, 10% .....	711 00
Annual interest on \$169,700 at 5% .....	8,485 00
Operation and administration .....	5,400 00
Thirty years' sinking fund at 5%—1.51% on \$169,700 .....	2,562 00
Total annual charges .....	\$24,271 00

Total annual cost of 1 H.P. at low tension busbars of North Bay sub-station on basis of 1,200 H.P. delivered, \$20.23.

August 12, 1908.

GAS PRODUCER REPORT.

During the year 1908 your Commission, in accordance with the request of the Legislature, made an exhaustive report on the cost of Power Production, through the agency of Producer Gas Plant and other prime movers under the conditions obtained in the Province of Ontario. The work was completed in the month of March, and during its operation a staff of expert engineers was engaged and detailed information was collected from all the well-known plants of both Canada and the United States. A large number of tests were performed on Gas Producer Plants and Engines with the object of obtaining as complete and reliable data as possible, and from the results obtained a comparison of the different classes of prime movers was made and formed into detailed, tabulated and technical information, which printed report was submitted to the Legislature in 1908. Your Commissioners have received enquiries from all over the world for this report, which is met with great favor amongst the engineering profession.



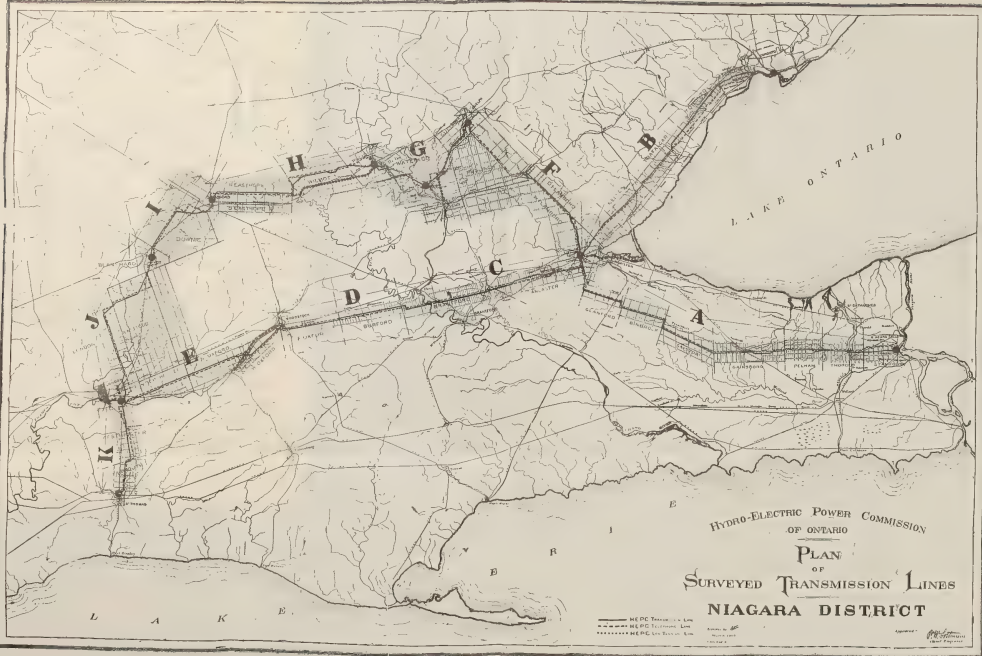
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## SECOND ANNUAL REPORT

FOR TEN MONTHS ENDING OCTOBER 31, 1909.

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# Hydro-Electric Power Commission.

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## SECOND ANNUAL REPORT.

### INTRODUCTORY.

In submitting the Second Annual Report, covering the year 1909 up to and including October 31st, it has been thought advisable to divide the report into the following sections, for the sake of clearness and reference:

- I. Transmission Line Construction—Niagara District.
- II. Station Construction—Niagara District.
- III. Hydraulic Work.
- IV. Municipal Work—Niagara District.
- V. General.

Actual construction of transmission line has been commenced in the Niagara district, and work on this line is proceeding in a rapid and favorable manner. Work will be continued through the winter, and the Contractor confidently expects to have the line completed within the limit set in the contract.

Work on the telephone lines and protective equipment which follow the highways to a great extent is being pushed to a speedy conclusion, as the telephone service will be of great value in the construction of other parts of the system.

Work on the stations is being rushed, and an effort is being made to have the roofs on before snow comes, so that work on the inside can be proceeded with during the winter.

Station Equipment, both mechanical and electrical, is under construction in the different factories, and will undoubtedly be completed when needed.

A number of reports on different water powers throughout the Province have been made at the request of the adjacent municipalities.

In some cases storage areas have been surveyed and reported on, and in the case of Dog Lake the specifications and plans for an increased storage capacity have been prepared for the Department of Public Works.

Considerable work is being accomplished in aiding the municipalities, so that they will have their systems in operating condition when the power is ready for delivery.

Your Chief Engineer and one of his assistants visited Europe in the early part of the year for the purpose of collecting data and information which would be of value to the Commission in its work.

P. W. SOTHMAN,  
*Chief Engineer.*

## TRANSMISSION LINE CONSTRUCTION.

### I. PRELIMINARY ENGINEERING, TESTS ON MATERIAL AND CONTRACTS.

#### (1) TOWERS.

Subsequent to the signing of the agreements of November 6th and November 25th, 1908, between the Commission and the F. H. McGuigan Construction Company, as incorporated in our Annual Report for 1908, considerable time was taken up in the discussion and adjustment of the various details of construction, organization, etc., and in the making of tests on the various types of apparatus entering into the construction of the line.

#### *Tower Tests.*

The design of tower submitted not being entirely satisfactory to the Commission, it was decided that two sample towers should be built, one to conform to the Contractor's design, and one to follow the Commission's design. This was done, and these towers were subjected to comparative tests. The results of these tests follow:

Tower No. 758—Commission's design.  
Tower No. 744—Contractor's design.

#### *Report on Tower Tests.*

The tests were performed in the order given below. Loads were applied by loading buckets with punchings and scrap iron, which were suspended from the point of load by cables.

#### *Tower No. 758.—Test No. 1, March 5th, 1909, a.m.*

The tower No. 758 was loaded for test 1 (a) after all loads had been applied, as per test sheet No. 1, at points 1 to 10. The deflection at the end of the arm was  $1\frac{1}{2}$  inches downward, readings being taken at point A. These loads were removed in the following order, and readings for vertical deflections taken at point A.

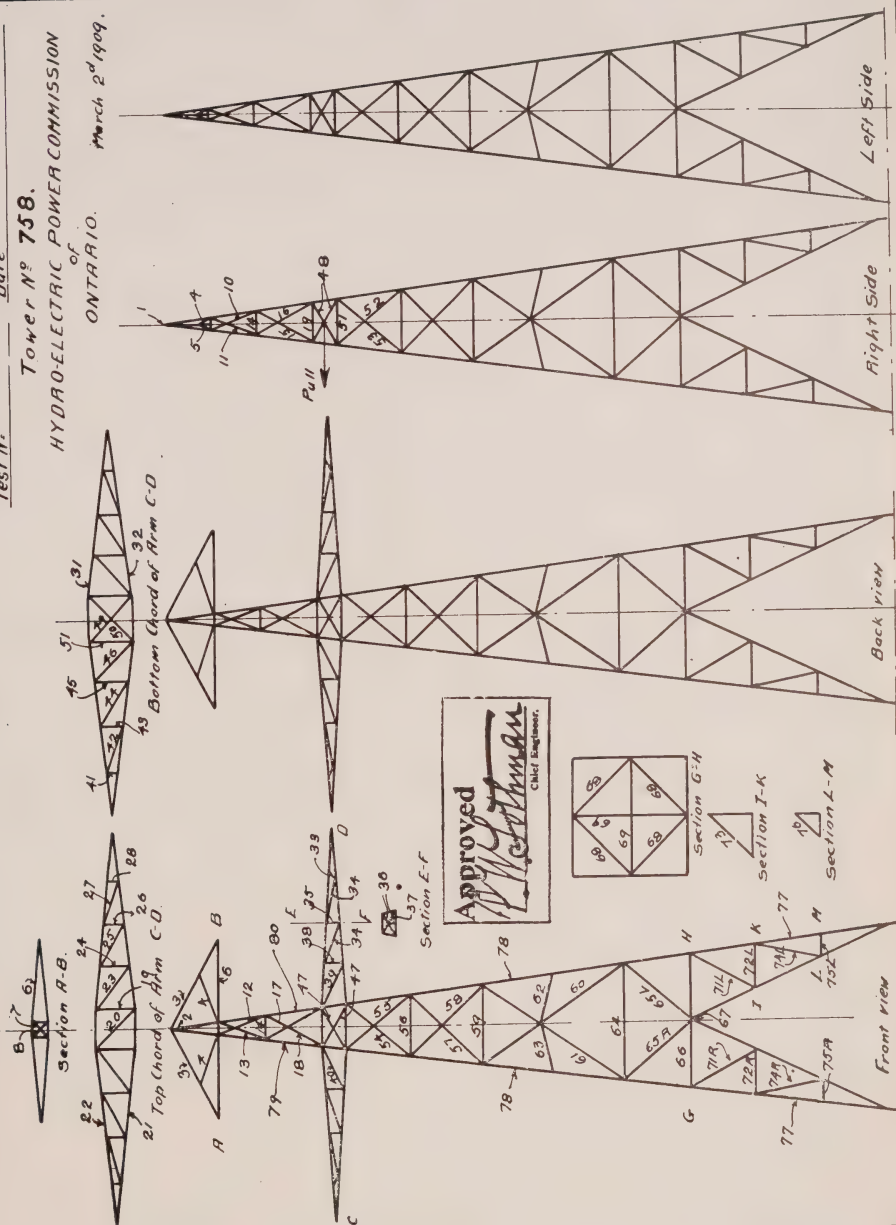
Removed Load.	Deflection.
No. 1.....	1.55
2.....	1.59
3.....	1.67
4.....	1.79
5.....	2.45
6.....	2.53
7.....	2.56
8.....	2.45
9.....	2.43
10.....	1.90

1.90 represented the permanent set of the cross arm. The above loading caused no strain in any part of the tower, the permanent set being probably due to slippage at bolts in arm.

On removing one of the cables suspending one of the loads as per test No. 1, the same was dropped and struck the third horizontal in the centre, jarring it considerably. On examination the angle was found to be bent  $\frac{3}{4}$  inch. Was taken out to be straightened.



Test N<sup>o</sup> \_\_\_\_\_ Date \_\_\_\_\_  
 Tower N<sup>o</sup> 758.  
 HYDRO-ELECTRIC POWER COMMISSION  
 of  
 ONTARIO.  
 March 2<sup>d</sup> 1909.





Test No. 2, March 5th, a.m.

The tower was loaded as per test 1 (b), the loads of 2,000 lbs. were applied at points 1 and 2, as shown in test sheet No. 2. The deflection of a point in the lower bracing of upper arm was measured by plumb bob placed at ground level. Two separate readings were made of the deflection of the cross under above loads, as follows:

- 1st. By means of transit and scale attached to end of arm at point A; and
  - 2nd. By means of the deflection of a measuring rod attached to the arm at B.
- A series of readings were also taken to note the twist of the main part of the tower under these loads, which are plotted on a separate sheet accompanying.

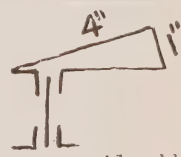
The following readings were taken for this loading, as per test sheet No. 2.

Loads.		Deflections.		
At point 1.	At point 2.	By measurement at B.	By transit.	By Plumb.
2,000	0	9/16	0.6	1/8
2,000	2,000	1 3/4	1.7	5/16
2,000	again 2,000	1 13/16	1.8	9/32
0	0	3/4	.....	.....

Loads continued after test 1 (c) had been performed.

Loads.		Deflections.		
At point 1.	At point 2.	By measurement at B.	By transit.	By plumb.
2,000	2,100	1 13/16	1.5	
2,100	2,100	1 27/32	1.6	5/16
2,200	2,100	1 7/8	1.65	
2,200	2,200	1 15/16	1.75	
2,200	2,300	2	1 8	
2,300	2,300	2 1/16	1.9	11/32
2,300	2,400	2 1/8	1.95	
2,400	2,400	2 1/4	2.05	3/8
2,400	2,500	2 9/16	2.1	13/32
2,500	2,500	2 9/16	2.15	
0	0	1/4 in.	0	0

After removal of loads a permanent twist of angles 21, 22, 31 and 32 at end of arm was noted, as per sketch, about 1 inch from horizontal in 4 inches.



The angles Nos. 57, 61, 65 and 76, which take compression, were considerably bent, indicating that the tension members were working. After load was removed, these angles returned to their original positions. This load did not cause any strain in tower other than the twist in the arms.



*Test No. 3, March 5th.*

Tower loaded as per test 1 (c) at point B, test sheet No. 3. Special harness was made of channels to apply the load to the four panel points at A, B, C and D. The cable connecting the load to harness was placed about 7 inches above the lower panel joints.

The following readings were taken for the loads:

A: Deflections of loads measured by measuring deflections of a measuring stick permanently connected to tower at A.

B: Readings by transit, reading on a scale placed at B.

C: Readings taken by plumb bob connected at C of horizontal cross bracing angle No. 50 of lower cross arm.

Loads.	Deflections.		
	A.	B.	C.
3,500	3/16	.15	3/16
4,000	1/4	.3	7/32
5,000	3/8	.4	5/16
6,000	15/32	.5	3/8
7,000	17/32	.52	15/32
8,000	5/8	.62	9/16
9,000	11/16	.65	5/8
9,500	23/32	.7	23/32
10,000	13/16	.75	3/4
Load removed.	0	0	0
10,000	13/16	.75	3/4
10,500	29/32	....	13/16
11,000	15/16	.9	21/32
11,500	1.	.95	7/8
12,000	1.1/16	.98	15/16
12,300	1.3/32	.99	31/32
12,400	1.3/32	.99	31/32
12,500	1.1/8	1.	1.
Loads removed.	0	0	0
12,500	1.1/8	1.	1.
13,000	1.7/32	1.05	1.1/8
13,500	1.1/4	1.1	1.5/32
14,000	1.5/16	1.15	1.7/32
14,500	1 3/8	1.23	1.9/32
15,000	1.7/16	1.27	1.3/8
Load removed.	1/16	Permanent set.	

At loading of 12,500 lbs. the bending of the long counter bracing angles 61, 65 L and 67 was noticed.

At loading 15,000 lbs. the left point of main leg angles No. 77 appeared to be slightly curved at the three lower panels, as per test sheet No. 3. The angles 67 were bent in on sides and out on front view. The counter angles 61 front, 60 side, 65 L, 57 front, 58 side, were bent out. On the removal of the load all of these angles returned to their original position, and the tower showed no points of strain.

## TEST OF TOWER NO. 744.

Test No. 1 was not performed on the tower, as the arms are similar in both cases, and it was deemed unnecessary.

*Test No. 2, March 6th, 1909.*

Loaded in the same manner as above tower, the following readings being taken of deflections:

A: Readings taken at A. Test sheet No. 2.

B: Transit readings of scale at B and C, plumb bob readings.

Loads.		Deflections.		
At point 1.	At point 2.	A.—Inc.	B.—Inc.	C.—Inc.
.....	2,000	11/16	.65	1/8
2,000	2,000	1.15/16	1.95	11/32
2,000	2,100	2.	2.00	.....
2,100	2,100	2.1/16	2.1	17/32
2,100	2,200	2.3/16	2.15	.....
2,200	2,200	2.7/32	2.2	17/32
2,200	2,300	2.1/4	2.25	.....
2,300	2,300	2.5/16	2.4	9/16
2,300	2,400	2.3/8	2.45	.....
2,400	2,400	2.9/16	2.55	19/32
2,400	2,500	2.3/4	2.65	.....
2,500	2,500	2.15/16	2.9	5/8
0	0	11/32	.3	.....

The above readings, on application of the various loads, show a uniform increase in the deflection.

Readings were taken for twist of the main tower. These are given on a separate sheet.

At 2,400 lbs. at points 1 and 2, angles 57, 63 and 69 on right side, and angles 58, 62 and 68 left side, were bent considerably, 57 showing a bend of at least 1½ inches, and showed a slight set after the removal of the load.

Considerable twist of the angles at the end of arm was noted. This took a permanent set after the removal of load.

*Test No. 2, March 6th, 1909.*

Load applied as per 1 (c) at point B, using a harness similar to that of tower No. 758. Readings were as follows:

A: Readings by measurement of deflections of measurement stick at A.

B: Readings of transit of scale at B.

C: Readings of plumb bob string.

Loads.	Deflections.		
	A.	B.	C.
3,500	1/4	0.	11/32
4,000	5/16	.05	13/32
5,000	11/32	.1	1/2
6,000	7/16	.2	9/16
7,000	17/32	.3	11/16
8,000	19/32	.45	25/32
9,000	11/16	.5	7/8
9,500	23/32	.55	15/16
10,000	7/8	.6	1.
0	1/16 set	.2	.....
10,500	15/16	.95	1.1/16
11,000	21/32	1.	1.1/8
11,500	1.	1.05	1.3/16
12,000	1.3/32	1.1	1.1/4
12,300	1.1/8	1.15	1.9/32
12,400	1.1/8	1.15	1.5/16
12,500	1.1/8 plus	1.15	1.5/16
0	1/8 set	.03	.....
12,500	1.5/16	1.25	1.13/32
13,000	1.3/8	1.3	1.15/32
13,500	1.13/32	1.4	1.17/32
14,000	1.1/2	1.45	1.5/8
14,500	.....	.....	.....

The load of failure was actually 14,500 lbs. plus the weight of one man, or 14,650 to 14,680.

The deflections show a uniform increment for increasing loads.

At 12,500 lbs. counters of panels 2, 3 and 4 are considerably bent, showing that tension members are working. Also the main leg member shows a slight curvature at middle of lower panel on right side. At 13,500 lbs. this becomes more marked and the curvature is continued to lower section of third panel from arm, and the curvature amounting to as much as  $\frac{1}{2}$  to  $\frac{3}{4}$  inch. At 14,500 lbs. (plus weight of man) the tower failed by the right leg member buckling at the lower half of the third panel down, the left leg immediately following, both legs bent out and buckled the counters of this panel.

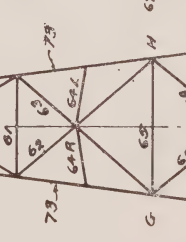
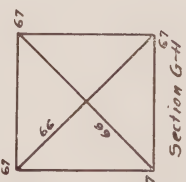
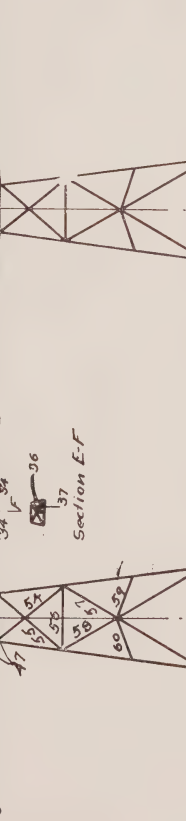
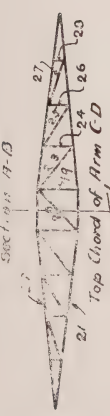
#### *Test of Upper Arm of Tower No. 758.*

Load applied in a horizontal direction at cable support of upper arm. Scale placed on end of arm. Readings being taken by transit as follows:

Load.	Deflection.	
2,000.....	3.	{ Scale twisted downward about $\frac{1}{8}$ inch.
2,100.....	3.05	.....
2,200.....	3.25	.....
2,300.....	3.45	{ Scale twisted about 4 inches to foot.
2,400.....	3.55	.....
2,500.....	3.99	.....
Load off.....	1.35	.....



Test N<sup>o</sup> \_\_\_\_\_ Date \_\_\_\_\_  
 Tower N<sup>o</sup> 744.  
 HYDRO-ELECTRIC POWER COMMISSION  
 of  
 ONTARIO.  
 March 2<sup>d</sup> 1909.





The arm was considerably twisted when load was applied, the angle being about  $^{\circ}$ .

When load was removed, the angle took a permanent set of 1.35 inch.

*Final Test of Tower No. 758.*

Applied loads as per 1 (c) and started with 10,000 lbs. as follows: Three buckets being connected to the pulling harness of channels. The entire bucket connection was 7 inches from lower arm, and the other two were connected at 9 and 11 inches respectively, from the lower arm.

The readings were as follows:

A: By measuring deflections at measuring stick placed at A.

B: By transit and scale at B.

Loads.				Deflections.	
Left Bucket.	Centre Bucket.	Right Bucket.	Total.	A.—Inc.	B.—Inc.
2,500	.....	.....	2,500	1/4	.....
2,500	.....	2,500	5,000	7/16	.....
2,500	5,000	2,500	10,000	7/8	.7
2,500	7,500	2,500	12,500	1.3/16	.95
2,500	8,500	2,500	13,500	1.9/32	1.05
2,500	9,000	2,500	14,000	1.11/32	1.1
2,500	9,500	2,500	14,500	1.7/16	1.2
2,500	10,000	2,500	15,000	1.15/32	1.3
2,500	10,500	2,500	15,500	1.17/32	1.4
2,500	11,000	2,500	16,000	1.5/8	1.45
2,500	11,500	2,500	16,500	1.11/16	1.5
2,500	12,000	2,500	17,000	1.25/32	1.55
2,500	12,500	2,500	17,500	1.13/16	1.60
2,500	13,000	2,500	18,000	1.29/32	1.70
2,500	13,500	2,500	18,500	2.	1.80
2,500	14,000	2,500	19,000	2.1/16	1.90
2,500	14,500	2,500	19,600	2.3/16	1.98
2,500	15,000	2,500	20,000	2.1/4	2.03
2,500	15,000	2,600	20,200	2.9/32	2.10
2,750	15,000	2,750	20,500	2.3/8 plus	2.15
2,750	15,200	2,750	20,700	2.13/32	2.20
2,750	15,450	2,750	20,950	2.1/2 & 2.5/8	Failed

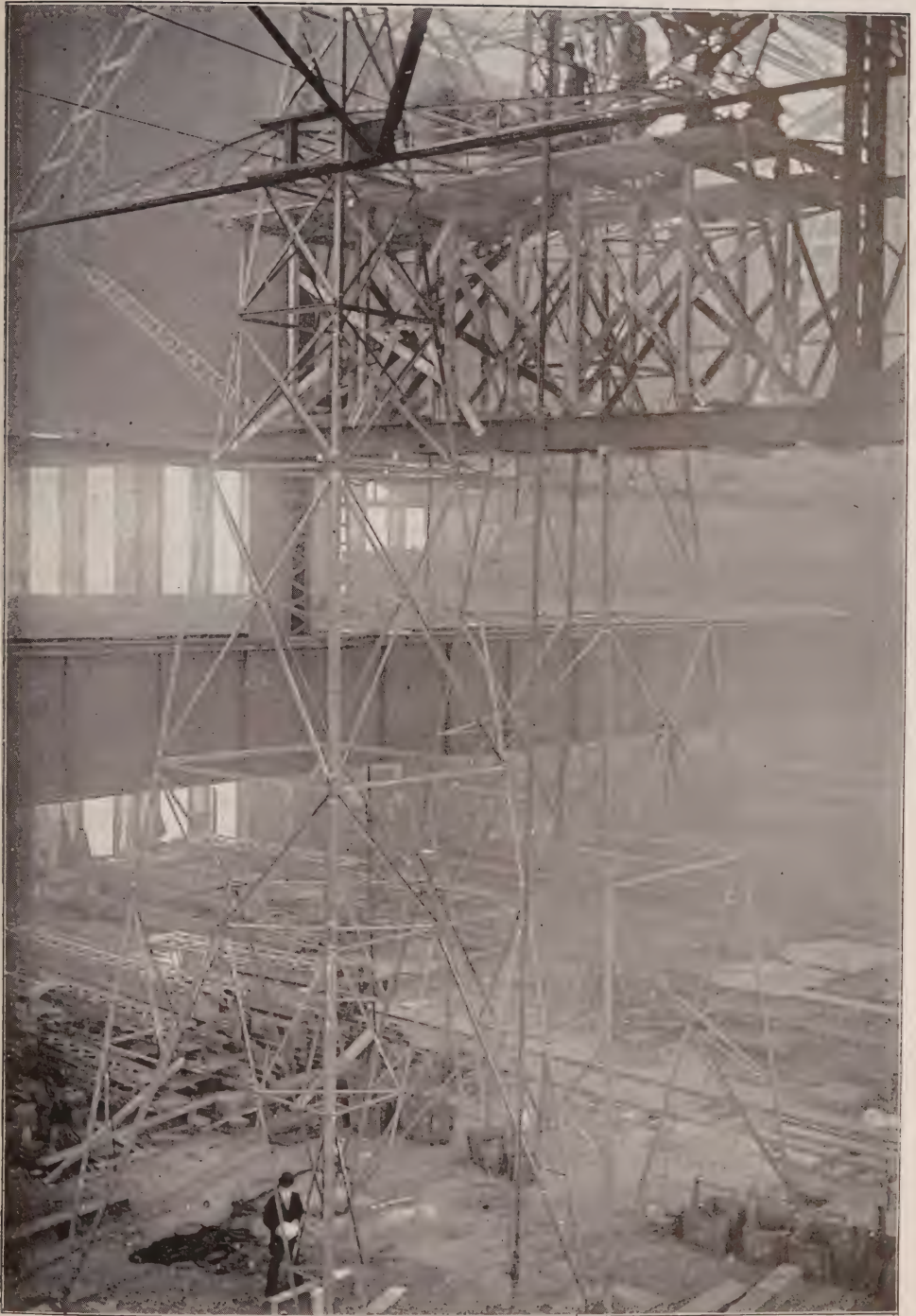
The tower failed by buckling of the left tower leg in lower panel and between connection of angles 71 and 70. It bent outwards at this point, the right leg immediately following and buckling in the same manner. This member had shown distress for some time before it actually failed. The loading at actual failure is somewhat less than recorded, due to the method of application.

After some slight changes, the plans of the tower following the Commission's design were approved for construction on March 19th, 1909, and the Contractor ordered to proceed with the fabrication. On April 5th the first order for 1,000 standard towers was given by the F. H. McGuigan Construction Company to their sub-contractors, the Canadian Bridge Company at Walkerville.

On April 13th the rolling mills started rolling steel for these towers. Galvanizing started about June 1st, but on account of delay in the galvanizing department it was not until July 6th that the first shipment of ten towers was made. Towers were shipped at the rate of five per day until July 20th, when shipments were increased to ten per day.



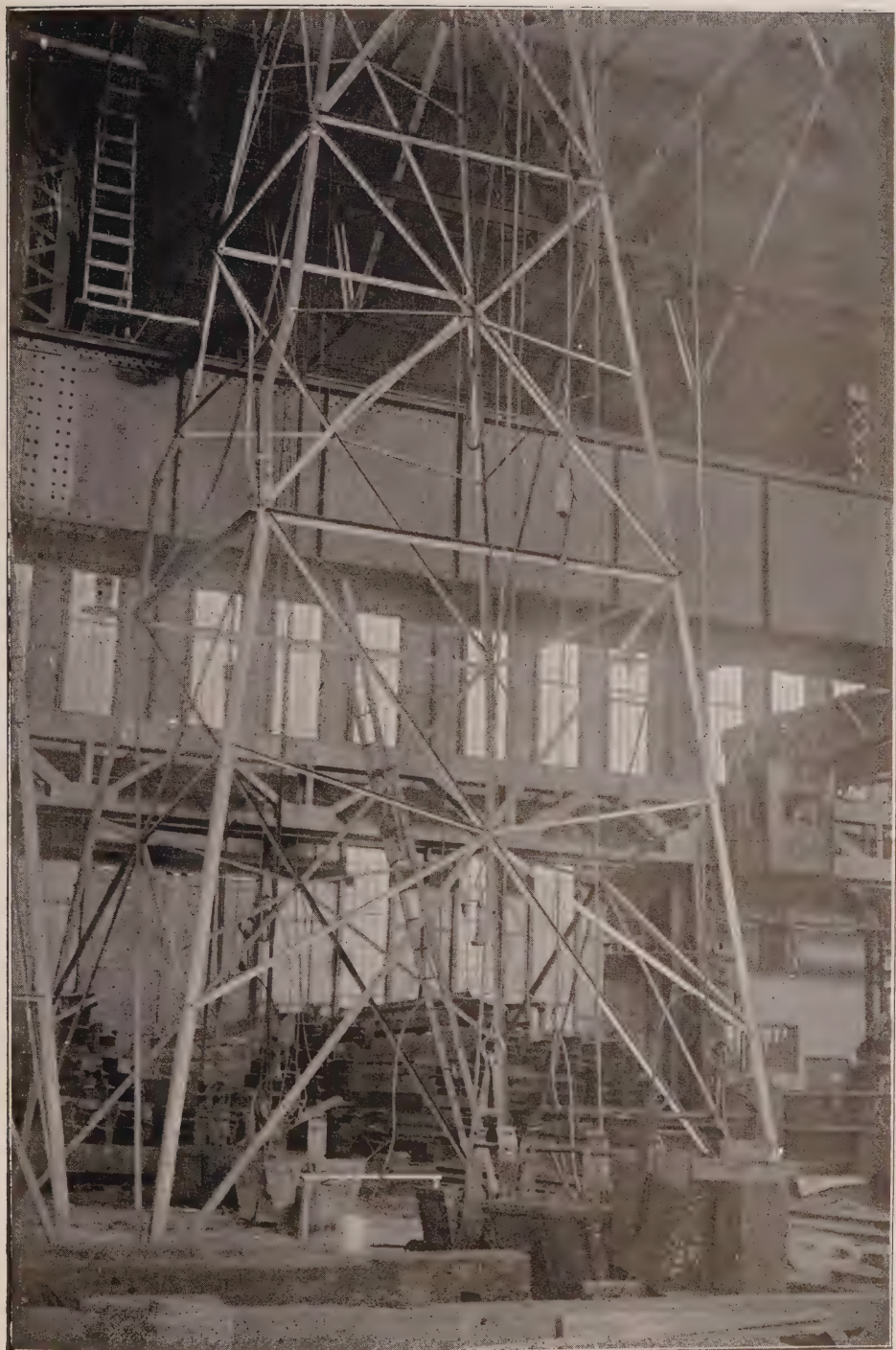




Test Towers in the Shop of the Canadian Bridge Co., Walkerville, Ont.







Failure of Contractor's Tower,

## (2) INSULATORS.

When it was decided to transmit power at 110,000 volts, it was also decided to adopt the suspension form of insulator in preference to the pin type, which had been the standard for all lines up to 60,000 volts. Before specifications were prepared, all insulator factories were visited, in order to collect data regarding the insulators themselves, to become acquainted with the method of their manufacture, and also to inspect the factories and determine their respective facilities, size, organization, etc. Tests performed at these factories showed such different results and performances that it was decided to have our own engineers make comparative tests on all insulators submitted under exactly the same conditions. With this object in view, the specifications called for the submitting of three complete sample insulators with each tender.

The Ontario Power Company, of Niagara Falls, in a very amiable manner placed all apparatus and machinery used in these tests at the disposal of the Commission, furnished all the power gratuitously, and assisted the Commission's Engineers in their work in a most willing and disinterested way.

After the samples of insulators accompanying tenders were received, they were submitted to very exhaustive tests, occupying the greater part of the time from February 8th, 1909, to May 18th, 1909, with the object in view of comparing the performance of the different makes, when subjected to exactly the same conditions. The most important condition was the application of artificial rain. The apparatus for this test was so arranged that all insulators were affected alike. The precipitation and direction of flow of water representing rain could be controlled, as could also the voltage to which the insulators were subjected.

As a means of comparison of the different results, characterized by a more or less vivid luminous display, a large number of photographic records were taken, the test being performed in absolute darkness.

In addition to the electrical tests, the mechanical features of the different insulators were thoroughly investigated. A great number of breaking tests were performed to ascertain the strength and rigidity of the insulators and their connections.

This investigation did not take the prices of the insulators into consideration. It was only after arriving at a definite conclusion as to the best-suited insulator that prices were taken into consideration and final selection of type was made.

The specifications for high tension insulators called substantially for an insulator to withstand electrically a potential of 330,000 (three times normal) volts, dry, and of 220,000 (twice normal) volts under a rainfall of half-inch of water per minute, combined with a wind strong enough to direct the flow of the rain at an angle of  $45^{\circ}$  towards the insulator. This was accomplished by means of a number of spray nozzles directed at an angle of  $45^{\circ}$  towards the insulator and the flow of water regulated until a precipitation of half-inch per minute was obtained.

Mechanically the suspension insulator, or the insulator from which the cable is suspended, was required to withstand a pull of 8,000 pounds without injury to any of its parts. The strain insulator, or the insulator which is used to take up the horizontal strain of the cable, was required to withstand a pull of 10,000 pounds.

Tenders were sent in by the General Electric Company, Schenectady, N.Y.; the Locke Insulator Company, Victor, N.Y.; the Ohio Brass Company, of Mansfield, Ohio; and the Hermsdorf Company, of Hermsdorf, Germany, through their Canadian representative in Montreal. In all there were seven different styles of insulator under consideration, the photographs of which are herewith reproduced.

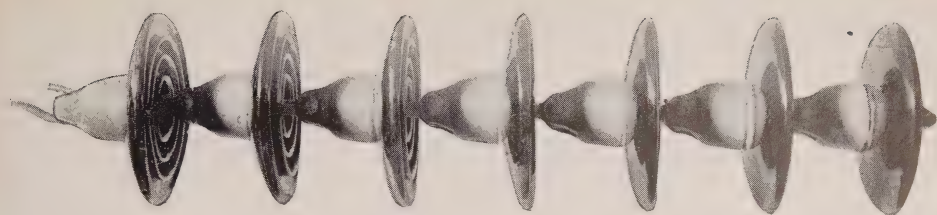
The Ohio Brass Company's insulators, after a few changes, were finally selected for both suspension and strain type, eight sections being used for the suspension type and ten reinforced sections being used for the strain type.

The tenders as submitted are reproduced herewith, together with the copies of agreements and contracts with the Ohio Brass Company.

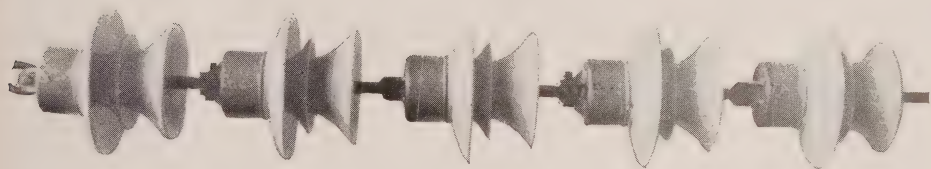


TENDERS FOR HIGH TENSION TRANSMISSION LINE INSULATORS.

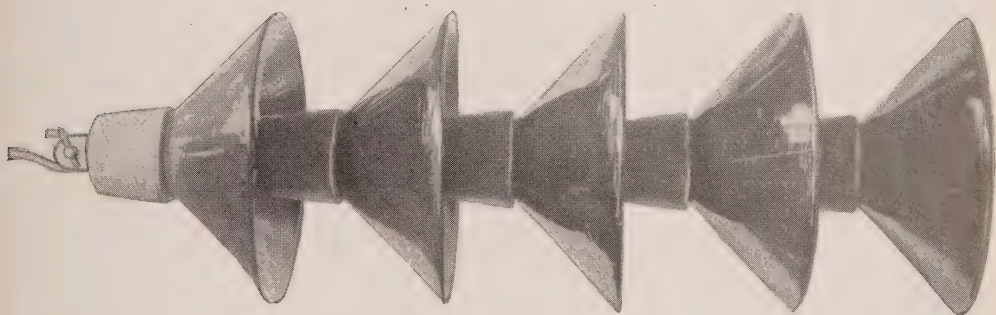
Tenderer.	Delivery 1st 1,000 Insulators in Weeks.	Suspension Type.						Strain Type.					
		Price per 100 F.O.B. R'y Sidings.			Price per 100 F.O.B. Cars Dundas.			Price per 100 F.O.B. R'y Sidings.			Price per 100 F.O.B. Cars Dundas.		
		First Order, 13,350.			Extra, 1,000—10,000.			First Order, 1,650.			Extra, 100—1,000.		
		Car Load Lots.	Less Car Lots.	\$ c.	Car Load Lots.	Less Car Lots.	\$ c.	Car Load Lots.	Less Car Lots.	\$ c.	Car Load Lots.	Less Car Lots.	\$ c.
		Sections.			Sections.			Sections.			Sections.		
General Electric Co., Schenectady, N.Y. ....	12	5	870 00	1,065 00	870 00	1,065 00	\$ c.	5	1,053 00	1,053 00	1,053 00	1,053 00	\$ c.
Locke Insulator M'g Co., Victor, N.Y. ....	8	5	1,065 00	1,148 13	1,065 00	1,148 13	\$ c.	7	1,491 00	1,491 00	1,491 00	1,491 00	\$ c.
R. Thomas & Sons, East Liverpool, Ohio. ....	23	5	1,148 13	1,148 13	1,148 13	1,148 13	\$ c.	6	1,377 75	1,377 75	1,377 75	1,377 75	\$ c.
Hernsdorf (Watson-Jack & Co., Montreal, Que.)	10	5	868 00	880 00	868 00	880 00	\$ c.	5	868 00	880 00	868 00	880 00	\$ c.
Ohio Brass Co., Mansfield, Ohio. ...	10	8	700 00	710 00	700 00	710 00	\$ c.	10	965 00	977 00	965 00	977 00	\$ c.



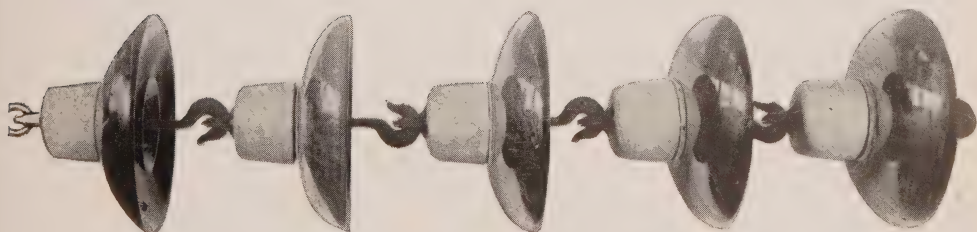
Proposed Ohio Brass Co.'s Suspension Type. Eight Sections.



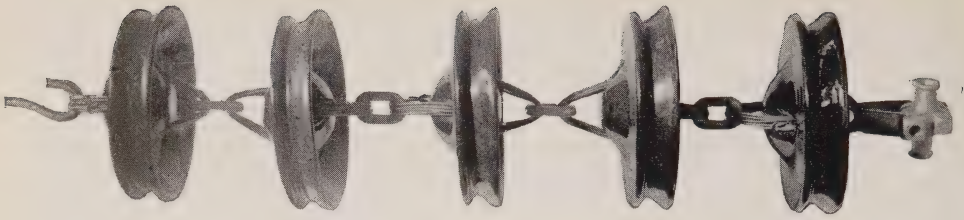
Proposed Hermsdorf Suspension Type.



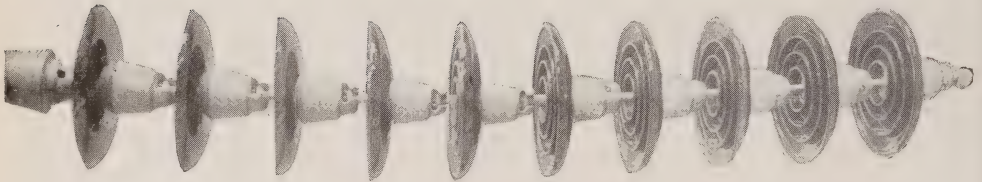
Proposed Locke Suspension Type.



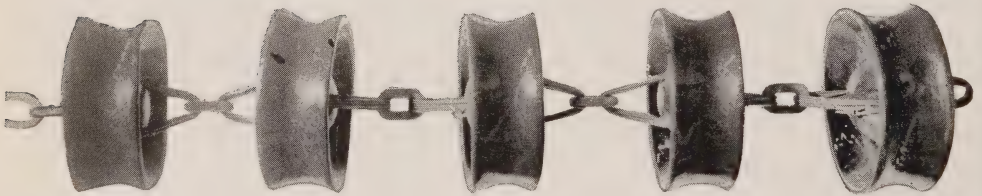
Proposed Thomas Suspension Type. 12-inch spacing.



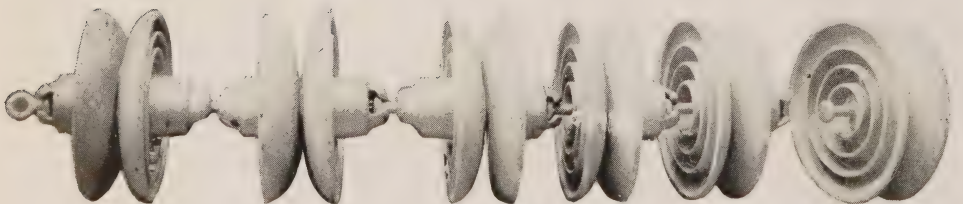
Proposed General Electric Co.'s Suspension Type.



Proposed Ohio Brass Co.'s Strain Type. Ten Units.

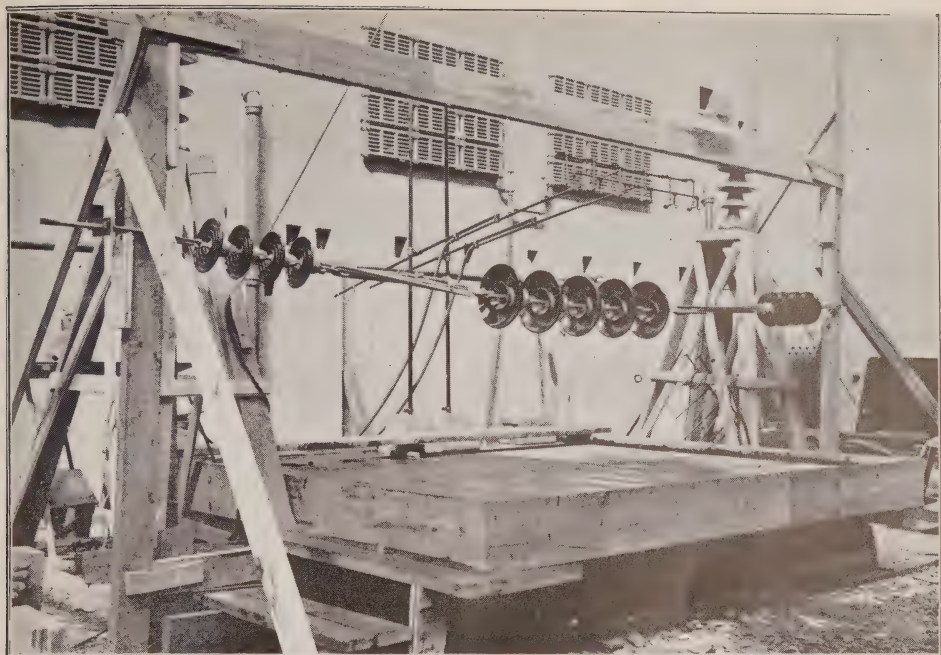


Proposed General Electric Co.'s Strain Type.

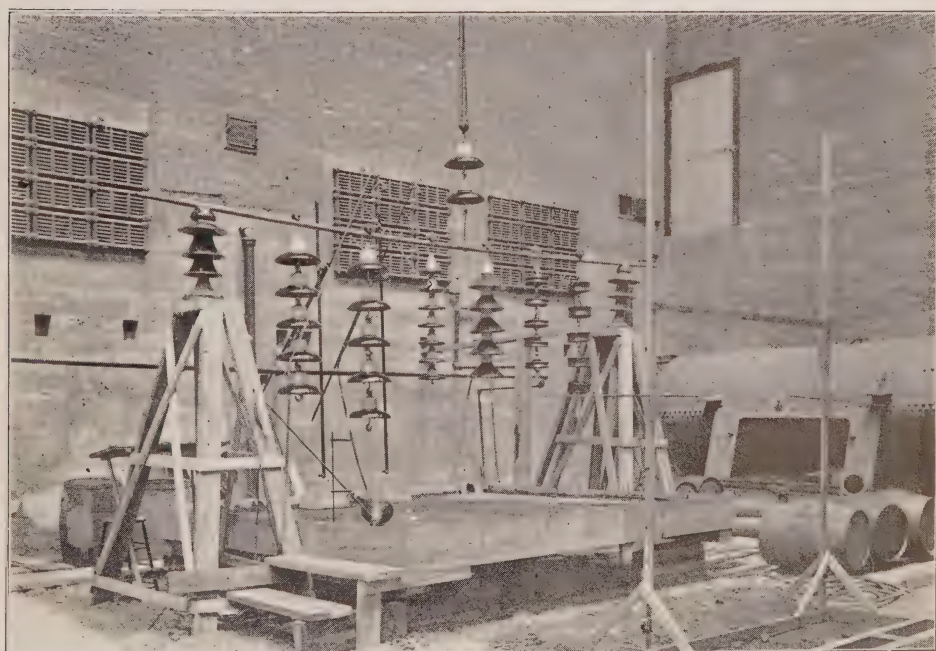


Proposed Ohio Brass Co.'s Double Strain Type.



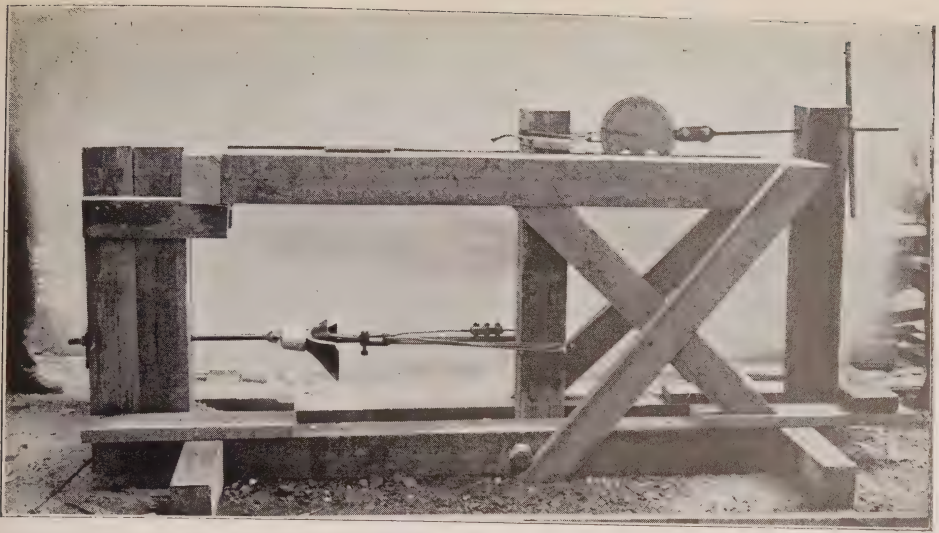


Testing Platform for Strain Insulators.

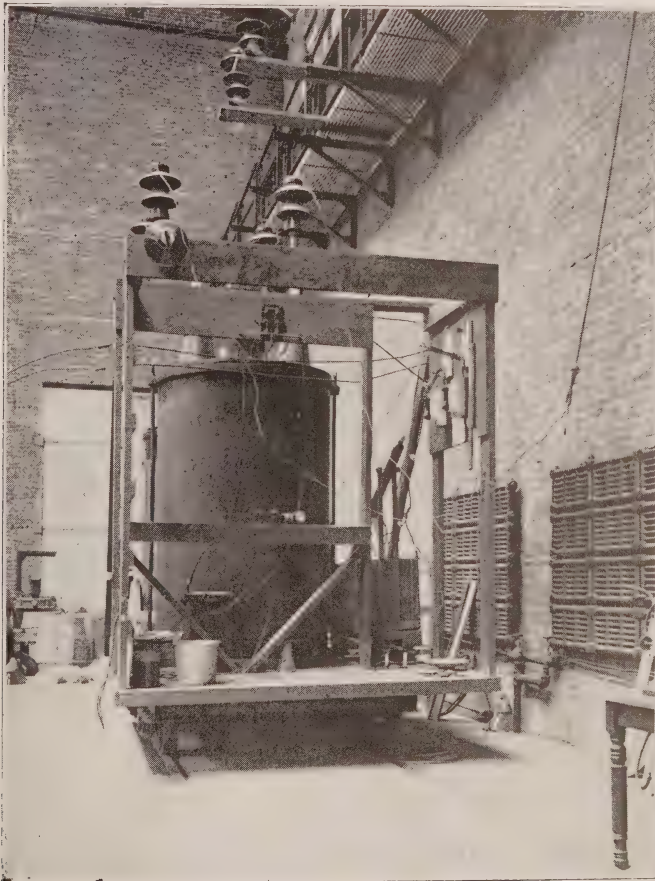


Testing Platform for Suspension Insulators.





Pulling Machine. To Determine Breaking Load of Insulator.



Testing Transformers.





Eleven thousand suspension units and three thousand strain units have been ordered from the Ohio Brass Company this year.

THIS AGREEMENT made in triplicate this twenty-ninth day of April, 1909,

BETWEEN THE OHIO BRASS COMPANY, of Mansfield, Ohio, hereinafter called the "Contractor," of the first part, and THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO, hereinafter called the "Commission," of the second part,

WITNESSETH, that the parties covenant, promise and agree with each other as follows:

1. The Commission's Specifications and General Conditions of Contract attached hereto and marked "A," with Commission's drawings No. 1-T-69, detail of "U" Bolt Connection to Transmission Tower, dated 4-19-09; Contractor's drawing No. 6,987 (Cap and Pin), dated 4-8-09, marked "B"; Contractor's approved drawing, as initialed and approved by the Engineer, marked "C"; Contractor's Bond, marked "D," and all specifications and drawings therein provided for shall form part of this contract.

2. The Contractor agrees:

(a) To deliver in cars, free of duty, freight and all other charges, 6,000 insulators—3,500, approximately, at points on steam railroad sidings between Niagara Falls and Dundas, and 2,500, approximately, at such points between Dundas and Toronto. The Engineer is to give his order under paragraph 8 (a) of said general conditions, not later than

Provided that the Contractor shall, prior to said date, have submitted samples of the said insulators satisfactory to the Engineer, and the same have been approved by him, otherwise the order shall not be given until the samples are approved. Within eleven weeks of such order the Contractor shall ship 1,000 to such points as the Engineer may, by fourteen days' previous notice in writing to the Contractor, direct, and 5,000 shall be shipped to such points as the Engineer may, by such notice, direct, in quantities between 1,200 and 1,700 each month.

(b) To deliver to the Commission a bond, satisfactory to the Commission, to secure the sum of Ten Thousand Five Hundred Dollars (\$10,500.00), for the proper performance of the contract.

(c) To use the best material and construct the said insulators in a thorough workmanlike manner, in strict conformity with the said specifications and drawings.

(d) On or before the 1st of December, 1909, upon request in writing, to enter into one or more contracts to deliver, at the same prices per 100, and upon the same terms, conditions, specifications and drawings, or as from time to time amended by mutual consent of the parties hereto, not less than 1,000 and not more than 25,000 additional insulators. From 1,200 to 1,700 are to be delivered complete each month. The Commission may, at its option, postpone first delivery under any such contract until 1st May, 1910. A surety company bond is to be given for 25 per cent. of the amount of any such contract.

3. The Commission agrees to pay to the Contractor for the said insulators \$700.00 per hundred, in carload lots of not less than 400 insulators, and \$710.00 per hundred in less than carload lots.

4. It is further agreed:

(a) For all purposes of this contract, notices shall be served upon the Engineer, or his appointee, in writing for the Commission, and upon the Secretary of the Contractor, or his appointee, in writing.

(b) All the rights and remedies of the Commission, and of the Engineer acting on their behalf, may be exercised and continued concurrently or in the alternative.

(c) Time shall be of the essence of this agreement.

(d) In case any municipal corporation which shall contract with the Commission for a supply of power, or any person, firm or corporation which shall contract with any such municipal corporation or with the Commission for a supply of power, shall suffer damages by reason of the breach of this contract by the Contractor, and such municipal corporation, firm, person or corporation would, if the Contractor had made this contract directly with them, have had a right to recover such damages or commence any proceedings or any other remedy the Commission shall be entitled to commence any such proceedings or bring such action in any Court in the Province of Ontario, for or on behalf of such municipal corporation, firm, person or corporation, and notwithstanding any acts, decision or rule of law to the contrary, the Commission shall be entitled to all the rights and remedies of such municipal corporation, person, firm or corporation, including the right to recover such damages; but no action shall be brought by the Commission until such municipal corporation, person, firm or corporation shall have agreed with the Commission to pay any costs that may be adjusted to be paid if such proceeding or action is unsuccessful. The rights and remedies of any such municipal corporation, person, firm or corporation shall not be hereby prejudiced.

(e) In case either of the parties shall, at any time or times, be unable to perform this contract by strike, lock-out, riot, fire, explosion, act of God, war or any other cause reasonably beyond their control, then the Contractor shall not be bound to deliver <sup>and</sup> <sub>or</sub> the Commission shall not be bound to accept insulators during such time, but the parties shall be prompt and diligent to remove the cause or causes of interruption in so far as they are able, and when such interruption has ceased the parties shall be prompt and diligent to perform the contract. Provided that if such interruption is, or is likely to be unreasonable, the arbitrators may determine that the parties shall be released from this contract.

(f) If any difference shall arise during the progress of the work as to any matter or thing arising under or out of this contract, such difference shall be referred to two arbitrators, one to be chosen by each of the parties hereto, and they shall choose a third arbitrator, but if they cannot agree, such third arbitrator shall be chosen by the Chief Justice at the time of the King's Bench Division of the High Court of Justice. When possible, the arbitrators shall decide such difference in a summary manner. Either party may appeal from any award of the arbitrators, as provided by the Arbitration Act, R.S.O., Chap. 62, but no such





Accepted Ohio Brass Co.'s Suspension Insulator Provided with  
Cable Clamps and Guards.



appeal shall be carried beyond the decision of the Court of Appeal of Ontario. The arbitrators shall not consider any difference or matter which is to be decided by the Engineer, or as to the grounds upon which, or mode in which, any opinion may have been formed or discretion exercised by the Engineer.

(g) This agreement shall extend to, be binding upon and enure to the benefit of the successors and assigns of the said parties.

IN WITNESS WHEREOF:

THE OHIO BRASS COMPANY,  
(Signed) A. L. WILKINSON, *Secretary*.  
A. BECK,  
*Chairman of the Commission*.  
JOHN S. HENDRIE,  
*Commissioner*.

#### GENERAL CONDITIONS.

The transmission system referred to in the Specifications is located in the Province of Ontario, Dominion of Canada. The high tension lines are designed to operate at approximately 110,000 volts, and the total length of line operating at this voltage will be about 300 miles. 1.  
Location of  
work.

(a) The word "Commission" shall mean the Hydro-Electric Power Commission of Ontario, Canada.

(b) The word "Contractor" shall mean the party to whom shall have been let the Contract or Contracts for the work to be done and for the materials to be supplied under the Specifications, or the legally appointed representatives, assigns, or executors, of said party. 2.  
Terms used.

(c) The word "Engineer" shall mean the Chief Engineer of the Commission.

(d) The word "Work" shall mean and include all the work to be furnished by the Contractor under this Contract, in the manufacture, testing and shipment of the materials he is to supply under the Specifications.

(e) The "Contract" shall mean and include, together with the formal Agreement, all Specifications and drawings further detailing, explaining, or modifying the materials, even though these drawings and Specifications be issued, with the approval of Engineer and Contractor, after the execution of said Contract.

(f) The word "Inspector" shall mean the person or persons duly authorized by the Engineer to inspect the materials under the Contract.

(g) It is understood that where, for purpose of brevity, terms "undamaged condition" or "safe delivery," or equivalent terms are used in these Specifications, General conditions and Agreement, they shall be construed as meaning Insulators or Units which have not cracked or broken, or the parts of which have not been loosened in transit to the steam railroad sidings to which said Contractor has shipped said Insulators or Units.

The execution of the contract shall involve and include:—

(a) The signing of the Drawings and Specifications by both the Contractor and the Commission. 3.  
Execution of  
contract.



(b) Within two weeks from the date of notification mailed to him to the effect that his tender has been accepted, the successful tenderer shall execute the Contract.

(c) The Contractor giving a Bond of a Trust or Guarantee Company, or of sufficient Sureties satisfactory to the Commission, for the completion and shipment of the materials and for the faithful performance by the Contractor of all the covenants, conditions and requirements specified in the Contract.

The Contract shall not bind the Commission unless and until the Bond shall have been duly accepted; nor shall it bind the Tenderer unless the Contract shall have been executed by the Commission within thirty days from the date of receipt of the Contract executed by the Tenderer.

Failure on the part of the successful Tenderer to comply with the requirements of this section shall constitute neglect and refusal, and his deposit shall become forfeit to the Commission.

4.  
Inspection.

The materials supplied under the Specifications shall be subject to inspection by the Engineer or by the Inspector, who shall at all times be given free access to the work of manufacture and ample facilities for the examination of the work in process of manufacture of Materials, and all assistance which he may require in the performance of his duties. The Contractor on beginning or resuming operations shall notify the Engineer, in due time, so as to enable him to arrange for proper inspection.

All materials condemned by the Engineer or Inspector shall be replaced free of charge, in a manner satisfactory to him, as provided in attached Specifications.

In case the Engineer or the Inspector observes improper workmanship or material in the course of manufacture, he shall call the same to the attention of Contractor, or the superintendent in immediate charge of that portion of the work, who shall order the workmen to remove such improper materials.

The inspection herein provided for shall in no way relieve the Contractor of full responsibility for the quality and character of the materials, as shown by the inspection and tests.

5.  
Additional  
material.

The Contractor will receive in excess of the sum named in his tender no compensation for any work done or materials furnished, unless said materials be furnished by written order of Engineer.

6.  
Labor and  
appliances.

Contractor shall provide at all time a sufficient force of mechanics and laborers and an ample quantity of the best and most suitable tools and appliances for carrying, manufacture, testing and shipment of the materials to a satisfactory completion within the time specified in the Agreement.

Should Engineer notify Contractor in writing that the force of men employed, or the number of tools and appliances supplied in carrying out the work of furnishing the materials governed by the Specifications are not sufficient, or that the character of said tools and appliances is not suitable, or that the methods employed are not for the best interest of the said work, or are not such as to indicate that said work will be completed within the time mentioned in Contract, Contractor shall forthwith increase the number of men employed on the work embraced

in the Specifications. Should Engineer notify Contractor in writing that materials governed by the Specifications are not arriving at such a rate, or within such a time as to indicate that the entire work will be completed in the time mentioned in the Contract, Contractor shall forthwith proceed to obtain such materials at the rate or within the time directed by the Engineer, or in the event of his failure to do so, Commission may obtain such material and deduct the excess in cost thereof from any moneys then due or to become due to Contractor.

No part of the work shall be sub-let unless by written consent of Engineer, Contractor stating in writing to Engineer the name of the Sub-Contractor to whom he proposes letting any portion of the work.

(a) The work shall not be commenced, nor shall any material be procured until Contractor shall have received a written order from Engineer to proceed; and it shall thereupon be at once begun and carried on continuously to completion, except as provided for in the Specifications.

(b) The materials under this Contract shall be completed and ready for shipment by the date therein specified, except as hereinafter provided; that, if, by reason of extra work, alterations or deviations from the Specifications, ordered by the Engineer and approved by Contractor, or through suspension of work by order of the Engineer, or through fires, strikes, floods, or through any other cause reasonably beyond the control of Contractor, he shall have been unduly delayed or impeded in the completion of the work, on a receipt of a written request from Contractor, Engineer may grant, in writing, such extension of time as appears to him fair and reasonable, and may assign some other day or days for the completion of the work under the Contract; this to be done without thereby prejudicing or in any manner affecting the validity of the Contract, or of any bond or surety.

Any and every such extension of time shall be considered to be in full satisfaction for, and in respect to, any and every actual and probable loss sustained or deemed to be sustained by Contractor, and shall in like manner exonerate him from any claim or demand on the part of the Commission for and in respect to the delay occasioned by the cause or causes for which any and every extension of time may have been granted, but not for or in respect to any delay continued beyond the time specified in the written notice of Engineer.

In case the Contractor shall neglect or refuse to sign the drawings and specifications before commencing work, or fail or neglect to commence work within six days after the date of the Engineer's order to commence, or such longer period as may be fixed by written notice, or if he shall become bankrupt, or insolvent or compound with his creditors, or commit any act of insolvency, or shall transfer, assign, or sub-let this Contract or any part thereof without the consent of the Engineer, or if he permits any execution to be levied on his property, or if the works or any part of them be not completed at the expiry of the respective periods specified and guaranteed in the Contract for completion; or in case at any time the work or any part thereof is, in the judgment of the Engineer, not executed or not being executed in a sound and workmanlike manner, to his satisfaction and in all respects in strict conformity with the Contract; or if the work or any part thereof is not progressing

7.  
Sub-letting.

8.  
Commencement, order and completion of work.

9.  
Forfeiture of contract.

continuously and in such manner as to insure its entire completion, in the opinion of the Engineer, within the time stipulated, or if the Contractor shall refuse or neglect forthwith when so ordered, to conduct the work so as to insure its completion within the time stipulated, or if the Contractor shall refuse or neglect to replace any defective or unsatisfactory work with proper material and workmanship, or to alter and amend any defective or unsatisfactory work in accordance with the specifications attached, or neglect or refuse to comply with any orders given him, within the scope of this Agreement, by the Engineer within the time specified in a written notice, or neglect, either personally or by a skilled or competent agent, to superintend the work, or if the Contractor shall persist in any course in violation of any of the provisions of the contract, the Engineer may forthwith declare the Contract forfeit, and in each and any such case, after at least twenty-four hours' notice, the Engineer shall have the full right and power at his discretion, without process or action at law, to take the whole work, or any part or parts thereof specified in the said notice, out of the hands of the Contractor; and the Engineer may either re-let the same to any other person or persons, with or without its being previously advertised; or may purchase such additional materials (all at such prices as he may think proper), and use all such reasonable means as he may consider necessary or advisable to secure the proper completion of the work to his satisfaction; and the Contractor and his Sureties in every case shall be liable for all damages, expenditure and extra expenditure, and for all additional cost of the work, which may be incurred by reason thereof. And all the powers of the said Engineer with respect to the determination of any doubts, disputes and differences, and the determination of the sum or sums or balance of money to be paid to or received from the said Contractor, and otherwise in respect of the Contract, shall nevertheless continue in force. The fulfilment by the Contractor of any stipulation in this Contract may be enforced by legal proceedings and judgment, or order of Court, without prejudice to any other remedy herein contained.

In case the work or any part thereof is taken out of the hands of the Contractor, as herein provided, it shall in no way effect the relative obligations of the Commission and the Contractor, or his Sureties, in respect of his or their obligations, or in respect of the remainder of the work (if any), nor shall it be any excuse for delay in completing the same. And if any balances of the Contract price, or other money payable by the Commission, shall remain in the hands of the Commission upon the completion of contract, the same shall be payable to the Contractor or the person legally representing him; but neither the Commission nor any officer thereof shall be liable or accountable to the Contractor in any way for the manner in which, or the price at which the said work or any portion thereof may have been or may be done or completed by the Engineer.

No work, or extra or addition work or charges shall be deemed to have been executed, nor shall Contractor be entitled to payment for the same, unless the same shall have been executed to the satisfaction of the Engineer in accordance with the Specifications and drawings, as evidenced by his certificate in writing, which certificate shall be a condition precedent to the right of Contractor to be paid therefor.



Commission shall have the right to suspend operations from time to time at any particular point, or upon the whole of the works. In the event of such right being exercised, so as to cause any delay to the Contractor, then an extension of time, equal to such delay, and to be fixed by Engineer, shall be allowed for completion of the Contract, and Commission shall pay Contractor all reasonable expenses arising from suspension of work, unless such suspension be due to some default on the part of Contractor. Contractor shall furnish Engineer with proper vouchers for all items upon which claim is made under this clause.

11.  
Suspension of  
work.

No such suspension shall violate this Contract or any part thereof, or release Contractor or others from any obligation hereby imposed, or bond, or surety for the performance of this Contract.

Contractor shall resume operations immediately upon receiving written instruction from Engineer to do so.

If the Commission continuously fail, neglect or refuse to perform this Contract, the Contractor may give notice to the Commission, setting forth such failure, neglect or refusal, and if within one month of the said notice, such failure, neglect or refusal has not been remedied by the Commission, the Contractor may submit the question of such failure, neglect or refusal to the arbitrators, and the arbitrators may, in addition to any other remedies, release the Contractor from this Contract.

(a) The Contractor shall pay all royalties (if any), and shall fully indemnify the Commission against all costs, judgments, or damages assessed against the Commission in suits or actions brought by any person or persons who base such suits upon his or their claim to be the Patentee or Patentees of any process used in connection with the work, or of any material, tool, or appliances used therein or therewith; and the Contractor shall furnish if desired proper licenses from the manufacturers of patented equipment used in the manufacture of the materials covered by this Contract, where failure to secure such licenses will result in delaying the progress of the work, or in loss to the Commission.

13.  
Responsibility  
regarding  
patents.

(b) On notification from the Commission, that such claim shall have been preferred, the Contractor shall, with the assistance, if necessary, of the Commission, at his sole expense conduct all negotiations for the settlement of the same, or any litigation arising therefrom.

All reasonable tests as per specifications attached hereto to determine that the quality of all materials conforms to specified requirements, whether tests are provided for or not, shall be made in a manner and with apparatus acceptable to the Engineer.

14.  
Tests.

During the progress of the work, the Engineer will submit such to suitable tests, at his discretion, as per specifications attached, to determine whether the requirements of the Contract shall have been complied with; upon satisfactory fulfilment of such requirements the Engineer will issue a certificate of such satisfactory tests.

At the end of each month the Engineer shall make a progress estimate of materials safely delivered during that month, which shall be used as a basis for paying the Contractor. Within twenty-five (25) days after the making of each such estimate, payment shall be made to the Contractor of an amount equal to seventy-five (75) per cent. of the value of all material safely delivered at steam railroad sidings as

15.  
Payment.

ordered and the balance, or twenty-five (25) per cent. of the value of all Insulators accepted at the pottery and safely delivered at steam railroad sidings shall be paid within three (3) months after the date of receipt of Insulators at said railroad sidings.

The monthly estimates as prepared by the Engineer shall embrace every allowance to which the Contractor is entitled, but should the Contractor have reason at any time to claim that an error has been made in the progress estimates, he shall notify the Engineer in writing at once of his dissatisfaction and of his reasons therefor.

No payment made upon any monthly estimate shall be construed as acceptance of the work done or of materials supplied or as a release of the Contractor from any responsibility under the Contract, nor as controlling the Engineer in the preparation of his final estimate.

Before, however, the final payment is made, the Contractor shall furnish the Commission with satisfactory evidence proving all claims, suits, liens and demands of his employees and of parties from whom material or apparatus used in construction of the material may have been purchased or procured to be fully satisfied, and materials furnished and work done on the contract to be released fully from all such claims, suits, liens and demands.

THIS AGREEMENT made in triplicate this \_\_\_\_\_ of July, 1909,  
BETWEEN THE OHIO BRASS COMPANY, of Mansfield, Ohio, hereinafter called the Contractor, of the first part, and THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO, hereinafter called the Commission, of the second part,

WITNESSETH, that the parties covenant, promise and agree each with the other as follows:—

1. The Commission's Specifications and General Conditions of Contract attached hereto and marked "A," with Commission's Drawings No. 1-T-69, Detail of U-Bolt Connection to Transmission Tower, dated 4-19-09; Contractor's Drawing No. \_\_\_\_\_ (Cap and Pin) dated \_\_\_\_\_, marked "B"; Contractor's approved Drawings, as initialed and approved by the Engineer, marked "C"; Contractor's Bond, marked "D," and all specifications and drawings therein provided for shall form part of this contract.

2. The Contractor agrees:—

(a) To deliver in cars free of duty, freight and all other charges, 1,650 10-unit, Strain type, porcelain insulators, 1,000, approximately, at points on Steam Railroad Sidings between Niagara Falls and Dundas, and 650, approximately, at such points between Dundas and Toronto. The Engineer is to give his order under Paragraph 8 (a) of said General Conditions, not later than \_\_\_\_\_, provided that the Contractor shall, prior to said date, have submitted samples of the said Insulators satisfactory to the Engineer and the same have been approved by him, otherwise the order shall not be given until the samples are approved. The Contractor shall ship by August 10th, 1909, 250 to such points as the Engineer may direct, and 1,400 shall be shipped to such points as the Engineer may, by such notice, direct, in quantities of 400 each month, in cars along with the standard suspension type insulators as required.

(b) To deliver to the Commission a Bond, satisfactory to the Commission, to secure the sum of Four Thousand Dollars (\$4,000) for the proper performance of the Contract.

- (c) To use the best material and construct the said Insulators in a thorough workmanlike manner in strict conformity with the said specifications and drawings.
- (d) On or before the 1st December, 1909, upon request in writing, to enter into one or more contracts to deliver, at the same prices per 100, and upon the same terms, conditions, specifications and drawings, or as from time to time amended by mutual consent of the parties hereto, not less than 500 and not more than 7,500 additional insulators. From 400 to 600 are to be delivered complete each month. The Commission may, at its option, postpone first delivery under any such contract until 1st May, 1910. A Surety Company Bond is to be given for 25 per cent. of the amount of any such contract.

(3) The Commission agrees to pay to the Contractor for the said Insulators \$965 per hundred, in carload lots of not less than 350 insulators, and \$977 per hundred in less than carloads lots. It is hereby understood that a carload lot may consist of both types of insulators when a total of 400 are shipped at any one time.

(4) It is further agreed:—

- (a) For all purposes of this contract, notices shall be served upon the Engineer, or his appointee, in writing for the Commission, and upon the Secretary of the Contractor, or his appointee, in writing.
- (b) All the rights and remedies of the Commission and of the Engineer, acting on their behalf, may be exercised and continued concurrently or in the alternative.
- (c) Time shall be of the essence of this agreement.
- (d) In case any municipal corporation which shall contract with the Commission for a supply of power or any person, firm or corporation or with the Commission for a supply of power, shall suffer damage by reason of the breach of this contract by the Contractor, and such municipal corporation, firm, person or corporation would, if the Contractor had made this contract directly with them, have had a right to recover such damages or commence any proceedings or any other remedy the Commission shall be entitled to commence any such proceedings or bring such action in any Court in the Province of Ontario, for or on behalf of such municipal corporation, person, firm or corporation, and notwithstanding any acts, decision or rule of law to the contrary, the Commission shall be entitled to all the rights and remedies of such municipal corporation, person, firm or corporation, including the right to recover such damages, but no action shall be brought by the Commission until such municipal corporation, person, firm or corporation shall have agreed with the Commission to pay any costs that may be adjusted to be paid if such proceeding or action is unsuccessful. The rights and remedies of any such municipal corporation, person, firm or corporation shall not be hereby prejudiced.
- (e) In case either of the parties shall, at any time or times, be unable to perform this contract, by strike, lock-out, riot, fire, explosion, act of God, war, or any other cause reasonably beyond their control, then the Contractor shall not be bound to deliver <sup>and</sup><sub>or</sub> the Com-



mission shall not be bound to accept Insulators during such time, but the parties shall be prompt and diligent to remove the cause or causes of interruption in so far as they are able, and when such interruption has ceased the parties shall be prompt and diligent to perform the contract. Provided that if such interruption is, or is likely to be unreasonable, the arbitrators may determine that the parties shall be released from this contract.

- (f) If any difference shall arise during the progress of the work, as to any matter or thing arising under or out of this contract, such difference shall be referred to two arbitrators, one to be chosen by each of the parties hereto, and they shall choose a third arbitrator, but if they cannot agree such third arbitrator shall be chosen by the Chief Justice at the time of the King's Bench Division of the High Court of Justice. When possible the arbitrators shall decide such difference in a summary manner. Either party may appeal from any award of the arbitrators, as provided by the Arbitration Act, R.S.O., Chap. 62, but no such appeal shall be carried beyond the decision of the Court of Appeal of Ontario. The arbitrators shall not consider any difference or matter which is to be decided by the engineer, or as to the grounds upon which, or mode in which, any opinion may have been forced or discretion exercised by the engineer.
- (g) This agreement shall extend to, be binding upon and enure to the benefit of the successors and assigns of the said parties.

IN WITNESS WHEREOF.

.....  
.....  
.....  
.....

(3) CABLE CLAMPS AND SLEEVES.

The transmission line cables will be attached to the insulator by means of clamps specially designed for the purpose. Two types of clamps are required, one for the suspension insulators, and the other for the strain insulators. The suspension clamp is a malleable iron casting with supporting grooves and carries a bolted cast clip for gripping the cable. Surrounding the cable is an aluminum sleeve formed of 1-16-inch plate which serves to protect it from any cutting or abrasion by the clamp.

The clamp also carries two sheet iron covers or shields which project over the cable at each end of the clamp to prevent short circuits from burning the cable, in case an insulator should fail or flash over.

The strain insulator clamps are formed of two plates of steel 1/4-inch thick bolted together and carrying grooves to receive the cable. Aluminum sleeves are also provided for these clamps to protect the cable from cutting. All clamps are galvanized.

Specifications and drawings have been prepared covering the above clamps and sleeves, upon which tenders were received, and contracts have been let for their manufacture as follows:—

12,000 Malleable Iron cable clamps for suspension type insulators to the Galt Malleable Iron Company, Galt, Ont., for the sum of \$6,602, delivered f.o.b. railroad sidings as required.

12,000 Aluminum sleeves for the above to W. H. Banfield & Sons, 120 Adelaide Street West, Toronto, for the sum of \$481.75, delivered to sidings as required.

4,000 Pressed steel cable clamps for strain insulators to Mr. W. H. Dunne, 1492 Queen Street West, Toronto, for the sum of \$2,149, delivered to sidings as required.

4,000 Aluminum Sleeves for pressed steel clamps to Mr. W. H. Dunne, for the sum of \$265, delivered to sidings as required.

The tenders for cable clamps follow:—

*Form of Tender Attached to Specifications for Malleable Iron Cable Clamps.*

..... the undersigned, hereby offer the Hydro-Electric Power Commission of Ontario to furnish all the necessary materials, labor, tools, machinery and other plant, and to execute and complete in a satisfactory and workmanlike manner all work required in connection with the **manufacture**, testing and shipment of Malleable Iron Cable Clamps, all according to the specifications and drawings exhibited to ..... at the following prices:—

Black Castings for 12,000 clamps, thoroughly cleaned and ready for galvanizing, for the sum of ..... dollars (\$ ) f.o.b. factory, or for the sum of ..... dollars (\$ ) f.o.b. Toronto, or at the rate of ..... cents ( c.) per pound at factory, or ..... cents ( c.) per pound f.o.b. Toronto.

Castings for 12,000 clamps thoroughly cleaned and galvanized according to specifications for the sum of ..... dollars (\$ ), delivered f.o.b railway sidings, or at the rate of ..... cents ( c.) per pound ..... further offer to supply 12,000 clamps complete with bolts, nuts and sheet iron covers, not galvanized, for the sum of ..... dollars (\$ ) f.o.b. factory, or for the sum of ..... dollars (\$ ) f.o.b. Toronto.

Or 12,000 clamps complete as above, but galvanized on all parts, for the sum of ..... dollars (\$ ) f.o.b. railway sidings.

The necessary bolts and nuts for 12,000 clamps, not galvanized, for the sum of ..... dollars (\$ ) f.o.b. Toronto, or the sum of ..... dollars (\$ ) f.o.b. railway sidings, or at the rate of ..... cents ( c.) per pound f.o.b. sidings.

The necessary bolts and nuts galvanized for 12,000 clamps for the sum of ..... dollars (\$ ) f.o.b. Toronto, or for the sum of ..... dollars (\$ ) f.o.b. railway sidings, or at the rate of ..... cents ( c.) per pound f.o.b. sidings.

Black Sheet Iron Covers at the rate of ..... dollars  
(\$     ) per 100 f.o.b. Toronto, or at the rate of ..... dollars  
(\$     ) per 100 f.o.b. railway sidings, or at the rate of ..... cents  
(     c.) per pound f.o.b. sidings.

Galvanized Sheet Iron Covers at the rate of ..... dollars  
(\$     ) per 100 f.o.b. Toronto, or at the rate of ..... dollars  
(\$     ) per 100 f.o.b. railway sidings, or at the rate of ..... cents  
(     c.) per pound f.o.b. sidings.

.....estimate that one clamp will weigh ..... pounds  
for the castings, ..... pounds for the bolts, and each pair of covers  
will weigh ..... pounds.

..... guarantee to ship the first 100 clamps within ..... weeks  
on receipt of order, and to regularly ship each week thereafter not less than  
.....clamps.

..... further hold ..... ready to enter into a Contract in  
form satisfactory to the Commission for the due and proper execution of the work  
at the rates and on the terms herein stated, and ..... further  
agrees to furnish securities for the due performance of the Contract in a bond  
for 25 per cent. of the amount of the entire contract with satisfactory sureties.

..... herewith enclose an accepted bank cheque payable to the  
order of the Chairman of the Hydro-Electric Power Commission of Ontario, for  
the sum of ..... dollars (\$     ), being 5 per cent. of the  
amount of the entire contract.

..... hereby certify that ..... have carefully investigated  
all conditions and items of cost which may or can possibly enter into the cost of  
the work to .....

Signed.....

P. O. ....

.....

.....

Dated .....



AUGUST, 1909.

## TENDERS FOR MALLEABLE IRON CABLE CLAMPS.

12,000 Clamps.	Condition.	F.O.B.	Pratt & Letchworth.		Galt Malleable Iron Co. Galt, Ont.	
			Rate per lb.	Total.	Rate per lb.	Total.
				\$ c.	c.	\$ c.
Castings only cleaned....	Not Galv ...	Factory.....	5.87	3,872.00	5.85	3,861.00
Castings only cleaned....	Not Galv ...	Toronto.....	6.07	3,998.00	6.05	3,993.00
Castings cleaned.....	Galvanized.	Ry. Sidings.	7.77	5,122.00	7.75	5,115.00
Clamps complete with bolts, nuts and sheet iron covers.....	Not Galv ...	Factory.....		5,190.00		5,182.00
Clamps complete with bolts, nuts and sheet iron covers.....	Not Galv ...	Toronto.....		5,350.00		5,345.00
Complete clamps.....	Galvanized..	Ry. Sidings.		6,611.00		6,602.00
Bolts and nuts only....	Not Galv ...	{ Toronto... }	5.75	551.00	5.56	546.00
		{ Ry Sidings }		572.00		567.00
	Galvanized..	{ Toronto... }	6.4	668.00	6.38	661.00
		{ Sidings... }		687.00		683.00
Sheet iron covers. ....	Not Galv ...	{ Toronto... }	5.63	660.00	5.60	650.40
		{ Sidings... }		681.60		672.00
	Galvanized..	{ Toronto... }	6.35	902.40	6.33	888.00
		{ Sidings... }		921.60		912.00
Estimated weight of one clamp :				Pounds.		Pounds.
Castings.. .. .				5.25		5.5
Bolts.....				.8924		.8925
Covers per pair.....				1.20		1.20
Total.....				7.3424		7.5925
First shipment of 100 clamps .....				6 Weeks		5 Weeks
Weekly shipments.....				250 Clps.		200 Clamps.

*Form of Tender Attached to Specifications for Pressed Steel Cable Clamps.*

..... the undersigned, hereby offer the Hydro-Electric Power Commission of Ontario to furnish all the necessary materials, labor, tools, machinery and other plant, and to execute and complete in a satisfactory manner all work required in connection with the manufacture, testing and shipment of Pressed Steel Cable Clamps, all according to the Specifications and drawings exhibited to ..... at the following prices:—

Pressed Steel Plates for 4,000 clamps, with all machine work but without bolts, thoroughly cleaned and ready for galvanizing, for the sum of ..... dollars (\$ ) f.o.b. factory, or for the sum of ..... dollars (\$ ) f.o.b. Toronto, or at the rate of ..... cents ( c.) per pound f.o.b. factory, or .....cents ( c.) per pound f.o.b. Toronto.

Pressed Steel Plates for 4,000 clamps, thoroughly cleaned and galvanized according to the specifications, for the sum of .....dollars (\$ ) delivered f.o.b. railway sidings, or at the rate of ..... cents ( c.) per pound.

..... further offer to supply the necessary bolts and nuts for 4,000 clamps, not galvanized, for the sum of .....dollars (\$ ) f.o.b. Toronto, or for the sum of .....cents ( c.) per pound.

The necessary bolts and nuts for 4,000 clamps, galvanized, for the sum of ..... dollars (\$ ) f.o.b. Toronto, or for the sum of ..... dollars (\$ ) f.o.b. railway sidings, or at the rate of ..... cents ( c.) per pound f.o.b. Toronto, or ..... cents (\$ ) f.o.b. railway sidings.

..... further offer to supply 4,000 clamps complete with bolts and nuts, and galvanized as specified, for the sum of ..... dollars (\$ ) f.o.b. railway sidings.

..... estimate that the pressed steel plates will weigh ..... pounds not galvanized, and that the necessary bolts will weigh ..... pounds.

..... guarantee to ship the first 100 clamps complete within four weeks on receipt of order, and to regularly ship each week thereafter not less than 150 clamps.

..... further hold ..... ready to enter into a contract in form satisfactory to the Commission for the due and proper execution of the work at the rates and on the terms herein stated, and ..... further agree to furnish security for the due performance of the Contract in a Bond for 25 per cent. of the amount of the entire Contract with satisfactory sureties.

..... herewith enclose an accepted bank cheque payable to the order of the Chairman of the Hydro-Electric Power Commission of Ontario for the sum of ..... dollars (\$ ), being 5 per cent. of the amount of the entire contract.

.....hereby certify that ..... have carefully investigated all conditions and items of cost which may or can possibly enter into the cost of the work to .....

Signed .....

P. O. Address .....

Dated .....

Dated Aug. 31, 1909.

COMPARISON OF PRICES SUBMITTED FOR PRESSED STEEL CLAMPS FOR STRAIN INSULATORS,

BY

CANADA FOUNDRY COMPANY, AND MR. W. H. DUNN.

Item.	Canada Fdy. Co.	W. H. Dunn.
<i>Black Plates (Pressed Steel):</i>		
For 4,000 clamps, F.O.B. Factory .....	\$1,375.00	\$1,172.00
For 4,000 clamps, F.O.B. Toronto .....	1,375.00	1,172.00
Rate per lb., Factory .....	.04	.06 1/2
Rate per lb., Toronto .....	.04	.06 1/2



Strain Cable Clamp.





*Galvanized Plates:*

For 4,000 clamps, F.O.B. Sidings .....	\$1,904.00	\$1,587.00
Rate per lb., Sidings .....	.05½	.08.8

*Bolts and Nuts, Not Galvanized:*

For 4,000 clamps, F.O.B. Toronto .....	\$338.00	\$543.00
Rate per lb., F.O.B. Toronto .....	.04.45	.06.8

*Bolts and Nuts, Galvanized:*

For 4,000 clamps, F.O.B. Toronto .....	\$421.50	\$675.00
For 4,000 clamps, F.O.B. Sidings .....	445.00	705.00
Rate per lb., Toronto .....	.05.45	.08.25
Rate per lb., Sidings .....	.05.77	.08.5

*Clamps, Complete, Galvanized:*

For 4,000 clamps, F.O.B. Sidings .....	\$2,531.00	\$2,149.00
--	------------	------------

*Weights:*

Plates, not galvanized, total .....	34,375 lbs.	18,000 lbs.
Bolts, not galvanized, total .....	7,600 lbs.	8,000 lbs.

*Shipments:*

First 100 .....	4 wks. of receipt of order.	4 wks. of receipt of order.
Rate per week afterwards .....	150 clamps.	150 clamps.

August 31st, 1909.

## COMPARISON OF PRICES SUBMITTED FOR ALUMINUM SLEEVES FOR STRAIN INSULATOR CABLE CLAMPS,

BY

W. H. BANFIELD AND PARKE &amp; LEITH.

Item.	W. H. Banfield.	Parke & Leith.	W. H. Dunn.
For 4,000 A1 Sleeves, F.O.B., Sidings .....	\$269.50	\$270.00	\$265.00
Rate per lb. ....	.60¾	.80	.56

*Shipments:*

First 500 .....	5 wks. of receipt of order.	5 wks. of receipt of order.	4 wks. of receipt of order.
Rate afterwards .....	150 per week.	150 per week.	150 per week.

## (4) POLE LINES.

Several municipalities whose requirements for power will not warrant the installation of separate step-down stations are to be supplied from the stations of adjacent municipalities, as follows:—

Ingersoll to be supplied from Woodstock Station.	
Galt " " " Preston "	
Hespeler " " " " "	
Waterloo " " " Berlin "	
New Hamburg " " " " "	

A wooden pole line construction located on highways will be used for carrying the necessary circuits, which will operate at 13,200 volts except in the cases of Galt and Hespeler, where the voltage will be 6,600.

In addition to the above, pole lines at 13,200 volts will be required to transmit power to the City of London from the Commission's step-down transformer station, which is located approximately three miles from the centre of the city.





..... hereby offer and agree to receive wire and cables f.o.b. cars at railway sidings, to unload, distribute and erect same on poles, for the following prices per mile for single wire or cable:—

0000 B. & S. Gauge Copper Cable at .....	Dollars (\$	)
2   "       "       "       "       " .....	Dollars (\$	)
4   "       "       "       "       " .....	Dollars (\$	)
345,000 C.M. Aluminum Cable " .....	Dollars (\$	)
0 B. & S. Gauge Aluminum Cable at .....	Dollars (\$	)
10 B. & S. Copper Telephone Wire " .....	Dollars (\$	)
$\frac{1}{4}$ in. Galvanized Steel Ground Cable.....	Dollars (\$	)

..... further agree in case the Commission requires similar lines to be erected in the vicinity of Stratford, St. Mary's, St. Thomas or Hamilton, to construct the same in accordance with the plans and specifications and at the same prices per mile as stated above.

..... further hold ..... ready to enter into a Contract in form satisfactory to the Commission for the due and proper execution of the work at the rates and on the terms herein stated and ..... further agree to furnish security for the due performance of the Contract in a bond for 25 per cent. of the amount of the entire contract with satisfactory sureties.

..... herewith enclose an accepted bank cheque payable to the order of the Chairman of the Hydro-Electric Power Commission of Ontario for the sum of ..... dollars (\$       ), being 5 per cent. of the amount of the entire contract.

..... hereby certify that ..... have carefully investigated all conditions and items of cost which may be or can possibly enter into the cost of the work to .....

Signed .....

P. O. Address.....

.....

.....

Dated .....

(5) UNDERGROUND POWER CABLES.

*Cables and Conduits for Connection with the Ontario Power Company.*

During the summer surveys were made at Niagara Falls along Murray Street, which had been determined upon as the most direct and feasible route for the connecting system between the Distributing Station of the Ontario Power Company and the Commission's step-up Transformer Station. In the meantime general specifications were being prepared and drawings issued, which, when completed, were sent out to all contractors known to undertake this kind of work, both in Canada and the United States. Tenders were received from three parties, and later the contract was let to Canadian Contracts, Limited, of Toronto, who were by far the lowest bidders.

The conduit system to be constructed will consist of two sections of 10 ducts each, paralleling each other in the same trench and 18 inches apart, the total length being approximately 2,000 feet. Seven manholes will be provided and spaced about 300 feet. These are required for jointing the cables to be placed in the ducts. The Contract with the Ontario Power Company provides that they shall transmit the power purchased by the Commission to their boundary line just east of the Michigan Central Railroad tracks. For this distance (300 feet) the above Company will provide a similar conduit system and install the necessary cables to connect with the Commission's system.

To cross under the tracks of the Michigan Central Railroad Company an order from the Board of Railway Commissioners is necessary and steps have been taken to obtain this.

Cables.

The first installation to supply three banks of transformers will require six cables. These shall be of the three-conductor, lead-covered type and are to operate at 12,000 volts. Specifications were written and sent out to all the known manufacturers in Europe and America. Tenders will be received on November 1st.

Form of Tender Attached to Specifications for Three-Conductor 12,000 Volt Cables.

....., the undersigned, do hereby offer to the Hydro-Electric Power Commission of Ontario to furnish all the necessary materials, labor, implements, tools, machinery, and other plant, and to execute and complete all works mentioned and described, in a satisfactory manner, for 12,000 volt cables, in accordance with the accompanying plans and specifications, and at the following prices:—

..... hereby offer and agree to furnish approximately 13,300 feet of three-conductor 12,000 volt cable in lengths from 280 to 360 feet as required, to unload same from cars, and complete the installation in every particular ready for service for the sum of ..... dollars (\$ .....).

..... hereby offer and agree to furnish approximately 13,300 feet of three-conductor cable in lengths from 280 to 360 feet on reels f.o.b. cars Niagara Falls, Ontario, with all duty paid at a price of ..... dollars (\$ ..... ) per foot, and estimate that the freight and duty charges will amount to ..... dollars (\$ ..... ) per foot.

The cable which ..... offer will be of the ..... insulation type and meets the accompanying specifications of the Commission in every particular, and ..... hereby guarantee the same for a period of five years against faulty materials or workmanship in accordance with the guarantee set forth in the specifications.

Characteristics of cable are as follows:—

Diameter of conductors.....	inches
Thickness of insulation around each conductor .....	inches
Thickness of insulation around group.....	inches
Thickness of lead sheath .....	inches
Outside diameter .....	inches
Weight per foot.....	pounds
Electro-static capacity per mile between conductors .....	micro-farads
between conductors and lead sheath .....	micro-farads
Least radius of bending at 40° Fahr.....	inches
Minimum temperature for safe installation.....	Degrees Fahr.

The insulating compound used in cable bells and joints will be ..... which will not carbonize or otherwise deteriorate from the effects of heat or high voltage, or both. Samples of cable and insulating compound are furnished herewith in accordance with the requirements of this specification.

..... guarantee that the insulation of the cables will not deteriorate under a continuous temperature of 150 deg. Fahr.

..... hold ..... ready promptly to enter into a Contract in form satisfactory to the Commission for the due and proper execution of this work for the sum and on the terms herein stated, and ..... further agree to furnish security for the due performance of the Contract in the form of a Bond for twenty-five per cent. of the amount of the entire Contract with sureties to the satisfaction of the Commission.

..... herewith enclose an accepted bank cheque, payable to the order of the Chairman of the Hydro-Electric Power Commission of Ontario for the sum of ..... dollars (\$ ..), being 5 per cent. of the amount of the tender.

..... hereby offer and agree, should the Contract be let to ..... to complete shipment within two months after date of notification from the Engineer to begin, manufacture, and to hand the entire work specified over to the Commission ready for operation within three months after such notification.

..... hereby certify that ..... are familiar with the conditions under which the Commission expect to operate the cables, and have investigated all items of cost which may or can enter into the cost of the work to ..... or the amount of tender submitted.

Signed .....

.. P. O. Address .....

.....

.....

Dated at .....

..... 1909.

*Form of Tender Attached to Specifications for Tile Conduit System for 12,000 Volt Cable at Niagara Falls.*

..... the undersigned, do hereby offer the Hydro-Electric Power Commission of Ontario, to furnish all necessary materials, labor, tools, machinery and other plant, and to execute and complete the construction of the Conduit System as described, in a satisfactory manner, in accordance with the accompanying Specifications, and at the following prices:—

..... hereby offer and agree to install the two sections of conduit as specified, together with all manholes complete, including concrete shelves, and all equipment with the exception of cast iron covers and framing for covers for the sum of ..... dollars (\$ ..), providing the tile ducts are supplied by ..... or for the sum of ..... dollars (\$ ..) if the ducts are supplied by the Commission.



..... hereby offer to install a single section of conduit throughout, together with all manholes completely equipped except for cover materials, for the sum of..... dollars (\$        ), if.....furnish the tile ducts, or for the sum of.....dollars (\$        ), if the ducts are supplied by the Commission.

.....offer to make a reduction of.....dollars (\$        ) for each section of ducts if ducts are protected with 4 inch walls of concrete throughout.

We offer the necessary 41¼ inch split tile ducts for protecting cables on man-hole shelves for .....cents per duct foot.

..... herewith ..... sending samples of tile ducts as required under the specifications.

.....guarantee the entire construction against defective materials or workmanship on our part, and agree to make any such defects good without cost to the Commission at any time within one year from date of acceptance.

The brand of cement we propose using for the work will be....., manufactured by..... at .....

.....hold.....ready promptly to enter into a contract in form satisfactory to the Commission for the due and proper execution of this work for the sum and on the terms herein stated, and ..... further agree to furnish security for the due performance of the contract in the form of a bond for twenty-five per cent. of the amount of the entire contract, with sureties to the satisfaction of the Commission.

.....herewith enclose an accepted bank cheque, payable to the order of the Chairman of the Hydro-Electric Power Commission of Ontario, for the sum of.....dollars (\$        ), being 3 per cent. of the amount of the Tender.

.....hereby certify that..... are familiar with the conditions under which the conduits are to be installed, and have investigated all items of cost which may or can enter into the cost of the work to.....

Signed.....

P. O. Address.....  
.....  
.....

Dated at.....

.....1909.

(6) TELEPHONE AND RELAY LINES.

In the specification for transmission lines it was provided that two telephone circuits should be erected between Niagara Falls and Dundas and one circuit paralleling the transmission lines of the remainder of the system. Later, when the question of automatic relay protection was taken up, the Westinghouse Company proposed a scheme which involved the use of two pilot wires to connect adjacent stations in which oil circuit breakers were to be located to divide the transmission lines into sections. This proposition was favorably considered and the contract let along with the contracts for station apparatus.

The pilot wires for connecting the several stations will be carried on the telephone poles in the same manner as the telephone circuits.

Specifications have been drawn up covering the construction of the pole lines to carry the telephone and relay circuits. The addition of the relay circuits has necessitated a change in cross arm construction on part of the lines and additional cross arms on the remainder. The F. H. McGuigan Construction Company submitted prices for the additional work, which were accepted. A contract has been entered into which covers these changes, also the completion of the relay circuits in every particular, except the supply of the necessary copper conductors, which will be furnished by the Commission. Specifications for this work follow.

*Copper Wire for Relay Circuits.*

As the copper wire for relay lines was to be furnished by the Commission, specifications were drawn up for the supply of same, and tenders were called for. Specifications and tabulated tenders follow. After due consideration, the contract was awarded to the Dominion Wire Manufacturing Co., of Montreal, for \$23,209.25.

*Form of Tender Attached to Specifications for Hard Drawn Copper Wire for Protective Relay Circuits.*

....., the undersigned, hereby offer to furnish to the Hydro-Electric Power Commission of Ontario all the necessary materials, labor, machinery and equipment and to execute and complete in a satisfactory manner all the works required in the manufacture, testing and delivery of "Hard Drawn Copper Wire for Protective Relay Circuits," all according to specifications exhibited to .....and will supply.....(       ) pounds of Hard Drawn Copper Wire at a price of.....cents per pound avoirdupois.

.....hereby offer and agree to furnish and deliver twenty thousand pounds of wire, all in accordance with the specifications and satisfactory to the Engineer within.....weeks after the execution of the contract and deliver .....pounds per week for succeeding weeks, until the amount contracted for is delivered.

.....further hold.....ready promptly to enter into a contract in form satisfactory to the Chairman of the Hydro-Electric Power Commission of Ontario for due and proper execution of the work at the rates and on the terms herein stated, and.....further agree to furnish security for the due performance of the contract by a bond for .....dollars (\$) with satisfactory sureties as specified.

.....herewith enclose an accepted bank cheque, payable to the order of the Chairman of the Hydro-Electric Power Commission, for the sum of.....dollars (\$)       ), as required in the "Instructions to Bidders," dated May .....

.....hereby certify that.....have carefully investigated all items of cost which do or can possibly enter into the cost of the work to.....

Signed.....

P. O. Address.....

.....  
.....

Dated at.....

.....

TENDERS FOR HARD DRAWN COPPER RELAY WIRE.

CALLED FOR MONDAY, MAY 10TH, 1909.

For use between	Size.	Lbs.	Eugene F. Philips Electrical Works.	Wire and Cable Company, Montreal.		Dominion Wire Manufacturing Company.		
			Price per 100lbs	Total.	Per 100.	Total.	Per 100.	Total.
	No.		\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.
Niagara Falls & Dundas.	8	60,800	14 85	9,028 80	14 85	9,028 80	14 85	9,028 80
Dundas and Toronto ....	9	34,040	14 85	5,054 94	14 85	5,054 94	14 85	5,054 94
Dundas and Woodstock..	9	21,400	14 90	3,188 60	14 90	3,188 60	14 85	3,177 90
Woodstock and London..	11	7,260	14 90	1,081 74	14 90	1,081 74	14 90	1,081 74
London and St. Thomas.	12	3,280	14 90	488 72	14 90	488 72	14 90	488 72
Dundas and Guelph .....	11	7,000	14 85	1,039 50	14 85	1,039 50	14 90	1,043 00
Guelph and Preston.....	12	2,820	14 90	420 18	14 85	418 77	14 85	418 77
Berlin and Preston .....	12	1,780	14 90	265 22	14 90	265 22	14 85	264 33
Berlin and Stratford....	11	8,260	14 90	1,230 74	14 90	1,230 74	14 85	1,226 61
Stratford and St. Mary's.	12	2,600	14 90	387 40	14 90	387 40	14 90	387 40
St. Mary's and London..	11	6,960	14 90	1,037 04	14 90	1,037 04	14 90	1,037 04
Total.....	.....	156,200	.....	23,222 88	.....	23,221 47	.....	23,209 25
First shipment of 20,000 lbs .....			One week .....	Two weeks.....		Two or three weeks.		
Shipments per week.. .....			50,000 lbs.....	50,000 lbs.....		20,000 lbs. or more.		

SUBMARINE AND UNDERGROUND CABLES FOR TELEPHONE AND RELAY CIRCUITS.

Specifications have been prepared for submarine cables to carry the telephone and relay circuits across the Welland Canal near Allensburg, also for underground cables of similar character to be used where the high voltage transmission lines of the Toronto and Niagara Power Co. are crossed in Pelham and Toronto Townships. The cables are designed for operation at 6,600 volts and may be used in either the telephone or relay circuits as occasion may require. Two cables are to be installed at each crossing, one for normal operation on each set of circuits.

These specifications were sent out with request for tenders along with the specifications for three-conductor 12,000 volt cables mentioned elsewhere, and tenders have been received from several firms well qualified to carry out the work of installation as well as of manufacture.



*Form of Tender Attached to Specifications for Submarine and Telephone and Relay Cables.*

....., the undersigned, do hereby offer to the Hydro-Electric Power Commission of Ontario to furnish all the necessary materials, labor, implements, tools, machinery and other plant, and to execute and complete all the work mentioned and described in a satisfactory manner, for submarine and underground cables, in accordance with the accompanying plans and specifications, and at the following prices:—

.....hereby offer and agree to furnish approximately 1,170 feet of six-conductor submarine cable in lengths as required, to unload same from cars, and complete the installation in every particular ready for service for the sum of .....dollars (\$ ).

.....hereby offer and agree to furnish approximately 1,170 feet of six-conductor submarine cable in lengths as required, f.o.b. cars Allenburg, Ontario, with all duty paid, at the price of .....dollars (\$ ), and estimate that the freight and duty charges will amount to.....dollars (\$ ).

.....hereby offer and agree to furnish approximately 850 feet of six-conductor underground cable in lengths as required, to unload same from cars, and complete the installation in every particular ready for service for the sum of.....dollars (\$ ).

.....hereby offer and agree to furnish approximately 850 feet of six-conductor underground cable, in lengths as required, f.o.b. cars Silverdale and Islington, Ontario, with all duty paid, at the price of.....dollars (\$ ), and estimate that the freight and duty charges will amount to.....dollars (\$ ).

The cable which.....offer will be in accordance with the implied requirements in every particular.

Characteristics of the cable are as follows:—

Weight of cable per foot, submarine.....pounds.

Weight of cable per foot, underground.....pounds.

Outside diameter of cable, submarine.....inches.

Outside diameter of cable, underground.....inches.

Size of reels.....inches by.....inches.

Greatest shipping weight of reels.....pounds.

Capacity of cables per mile.....M.F.

Least radius of bending.....inches.

Samples of each kind of cable and photographs showing pot heads of terminal boxes are furnished herewith in accordance with the specifications.

.....guarantee that the cables will not deteriorate or become inoperative for a period of five years from date of installation through faulty materials or workmanship on.....part, and.....agree to replace any cables becoming inoperative for such reason.

.....hold.....ready promptly to enter into a contract in form satisfactory to the Commission for the due and proper execution of the work for the sum and on the terms herein stated, and.....further agree to furnish security for the due performance of the contract in the form of a bond for twenty-five per cent. (25%) of the amount of the entire contract, with sureties to the satisfaction of the Commission.

.....hereby enclose an accepted bank cheque, payable to the order of the Chairman of the Hydro-Electric Power Commission of Ontario, for the sum of ..... dollars (\$ ), being 5 per cent. of the amount of the tender.

.....hereby offer and agree, should the contract be let to.....to complete shipment within six weeks from receipt of order, and to install same if required to do so, within two weeks of said date.

.....hereby certify that.....have investigated all items of cost which may or can enter into the cost of the work to.....

Signed.....

P.O. Address.....

.....

.....

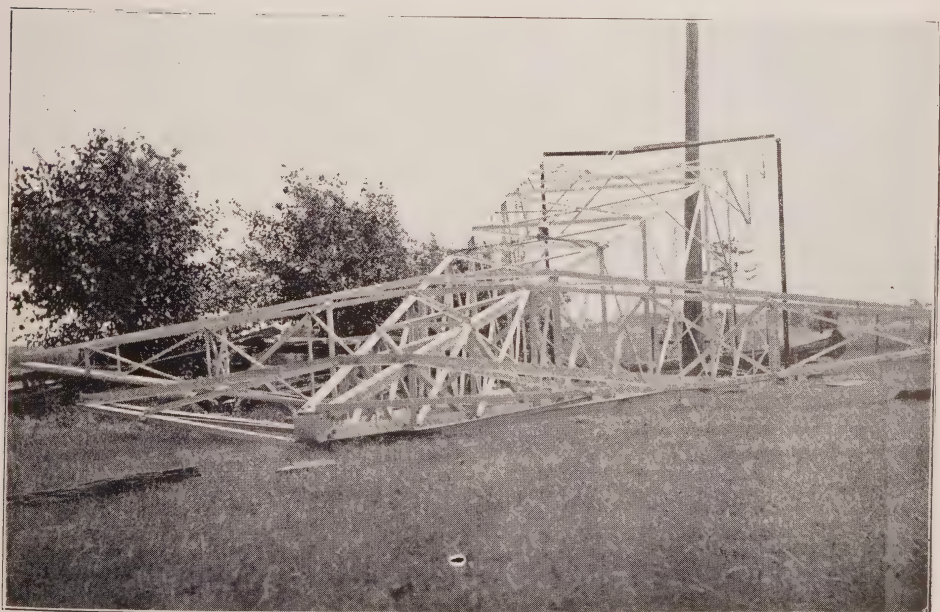
Dated at.....

.....1909.

\_\_\_\_\_



Footings being set by means of Special Template, to which the Four Footings are bolted.



Standard Tower Assembled. Ready for Erection.





## II. CONSTRUCTION—NIAGARA DISTRICT.

## PRELIMINARY SURVEYS—NIAGARA DISTRICT.

*Right of Way.*

At the close of 1908 the following routes for the 110,000 volt transmission lines had been surveyed:

	Distance in Miles.
Section A, Niagara Falls to Dundas .....	51.5
" B, Dundas to Toronto city limits .....	36.4
" C, Dundas to western limits of Brantford Township .....	27.9
" D, Brantford Township to Woodstock .....	16.6
" E, Woodstock to London .....	25.5
" F, Dundas to Guelph .....	25.4
" G, Guelph to Stratford through Preston and Berlin .....	44.0

These still remained:—

" H, Stratford to London through to St. Mary's .....	37.3
" I, London to St. Thomas .....	13.4

One survey party, consisting of an engineer and an average of three chainmen, has been engaged in this work. In the past ten months the party has completed these surveys, together with special surveys of some 90 crossings of canals, railways, telephone lines, telegraph lines and transmission lines.

Special surveys have also been made of a number of sections of the line where unusually long spans were required, as well as surveys of ten station sites, thus completing all preliminary surveys of the 110,000 volt system, excepting that within the limits of the City of Toronto.

*Organization.*

At the beginning of January, 1909, there were four right-of-way agents in the field, under the direction of an engineer. This organization continued to the middle of February, when arrangements were made for paying for right-of-way, and all right-of-way work was placed under the supervision of the Solicitor for the Commission, one of the former agents being appointed as his assistant to direct the work. At this time the head right-of-way agent was in charge of two others, which number was later increased to eight, the new men being chiefly engaged in arranging with owners for payment for right-of-way privileges and for the cutting of trees.

After the middle of summer the number of agents was gradually reduced, the number at present being four, with a fifth in charge.

*Progress of Work.*

At the beginning of the year only a portion of the lines had been canvassed for right-of-way. Along this portion, agreements had been made for the right to erect and maintain towers and lines, to patrol, and the right to remove trees and underbrush, but no arrangements had been made for the work of clearing. Since it had been agreed that owners retain the timber, it was deemed advisable to have them do the cutting, and although to make the agreements for this cutting necessitated extra work for the buyers, it proved to be the most satisfactory arrangement for both parties.

Owing largely to the agitation caused by opponents of the power scheme, the work of securing right-of-way has been difficult. Directly and indirectly, through the influence of such, the owners have been induced not only to refuse to make arrangements for right-of-way, but also to refuse the Commission access to right-of-way for which agreements had previously been made.

Notwithstanding these difficulties, progress has been made. During the past ten months agreements have been made for 94 miles of right-of-way not heretofore obtained, and for the cutting of timber along 211 miles of the line. Nine properties, comprising a total of about 45 acres, have been purchased for sites for interswitching and transformer stations, also right-of-way for some 23 miles of telephone line through private property has been obtained.

The greater portion of the above right-of-way and property has been paid for and is in the hands of the Commission.

### *Tower Lines—Field Organization.*

The engineering work in the field is under the direct supervision of the Field Engineer in charge of construction. The work in each section is in charge of a Resident Engineer, under whom is a transitman and also the Inspectors in charge of various branches of construction.

Before construction work is started in any section, the Resident Engineer is supplied with the necessary transmission line plans and data, and the transitman, with a party of two to four men, covers the section and stakes out the location of the towers. The Contractor then places a gang in the field to excavate foundation pits upon the locations established by the survey party. Following this is a second gang, which sets the steel footings; this is in turn followed by a gang which assembles the steel for the towers. A gang then follows with the necessary apparatus for raising the assembled towers to their final position and bolting them to the footings.

Every construction gang, with the exception of the digging gangs, is accompanied by an Inspector, who supervises the details of construction in the interests of the Commission.

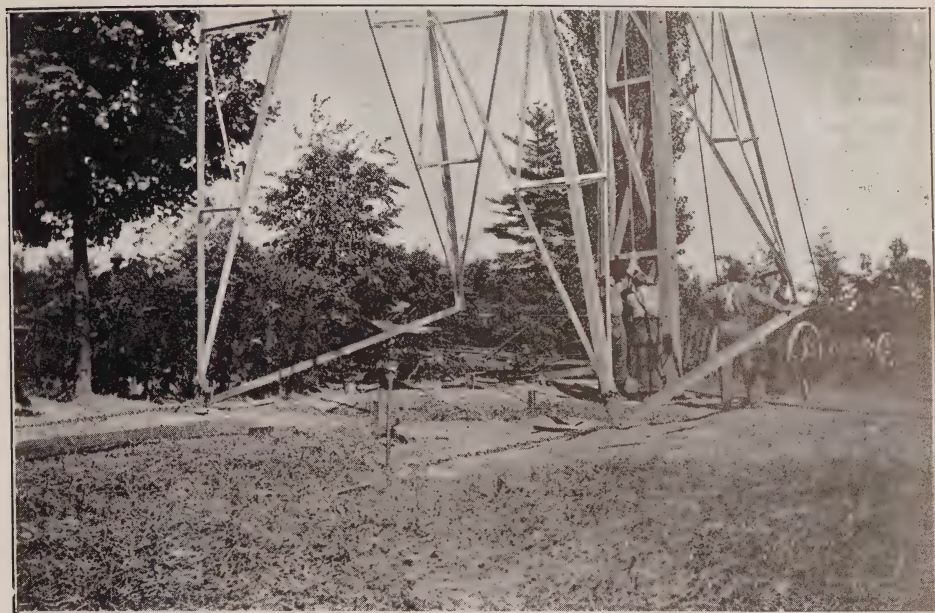
Daily progress reports are sent to the Toronto office by Inspectors, and also weekly reports, which are prepared under the supervision of, and signed by, the Resident Engineer. From these reports, tables, diagrams and curves are compiled by the office staff, which allow a close check to be kept on the progress of the work in all parts of the system.

### *Progress of Construction.*

The first tower was erected on July 22nd, 1909, near Rymal in the Township of Glanford, and since then the work has been progressing steadily. Up to October 31st, 1909, the work done on the transmission line is as follows:

#### SECTION A.—NIAGARA FALLS-DUNDAS.

Total distance—51.5 miles.	
Total number of towers required.....	573
“ “ “ delivered to date .....	354
“ “ “ erected to date.....	276
“ “ “ footings set.....	296



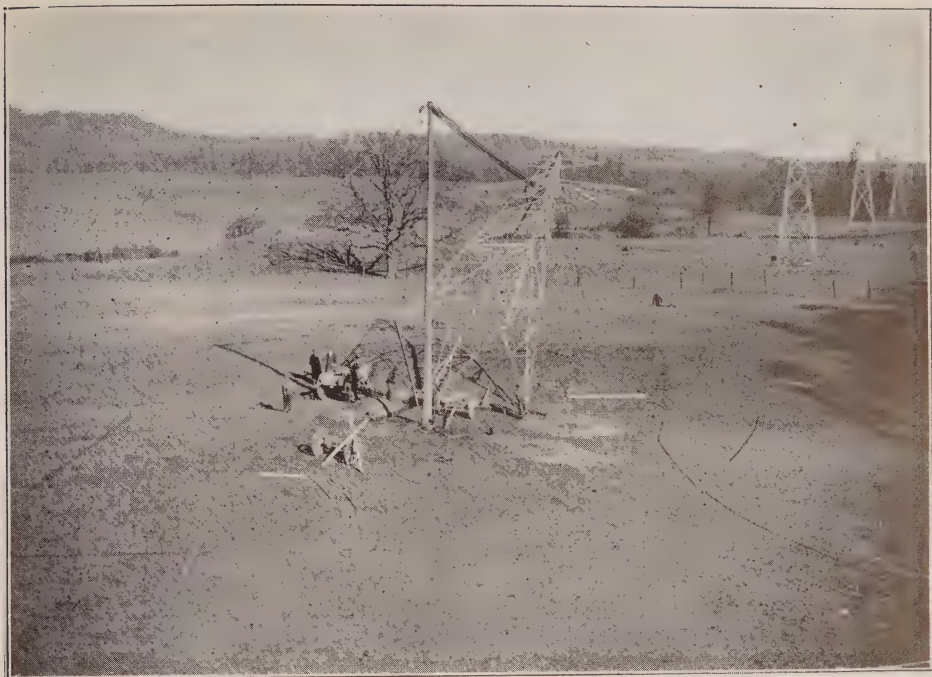
Showing Method of Erecting Towers. Bracing of Legs to Prevent Bending.



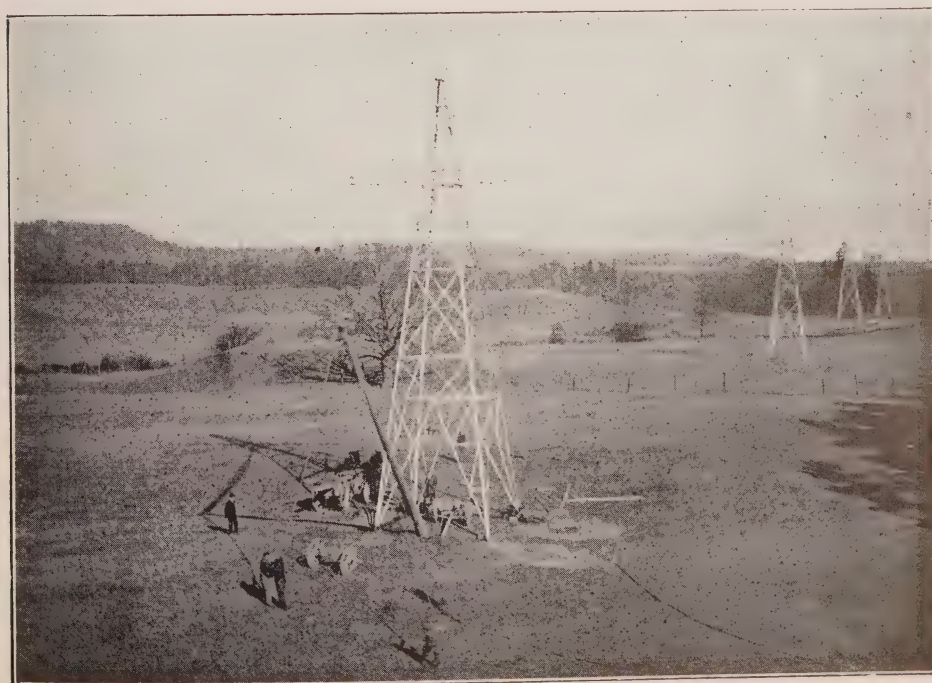
Erection of Standard Tower, Dundas Valley.





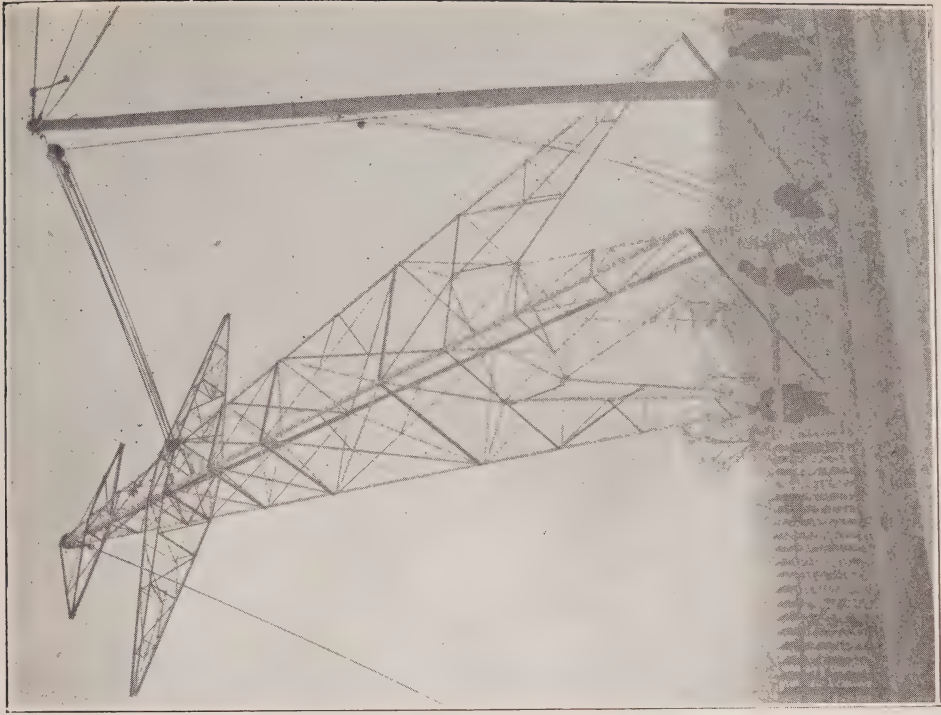


Erection of Standard Tower, Dundas Valley.



Erection of Standard Tower, Dundas Valley.





Standard Tower. One Half-way Up.



Line of Standard Towers in Niagara-Dundas Section.





## SECTION B.—DUNDAS-TORONTO (CITY LIMITS).

Total distance—36.3 miles.			
Total number of towers	required....		391
" " "	delivered to date.....		261
" " "	erected to date.....		109
" " "	footings set .....		202

## SECTIONS C. AND D.—DUNDAS-WOODSTOCK.

Total distance—44.5 miles.			
Total number of towers	required.....		480
" " "	delivered to date.....		11

## SECTION F.—DUNDAS-GUELPH.

Total distance—25.4 miles.			
Total number of towers	required.....		270
" " "	delivered to date .....		...
" " "	erected to date.....		22
" " "	footings set .....		50

Instructions have been given to the Contractor to push the work of setting footings, in order that as many as possible may be placed before freezing weather, so that the assembly and erection of towers can be carried on throughout the winter.

*Insulators.*

There have been delivered in Ontario to date 1,368 suspension type insulators. The work of erecting these started on Section 17 on Oct. 14th, and to date there have been 888 complete units erected on the towers.

## TELEPHONE AND PROTECTIVE SYSTEM.

A telephone line and protective relay system to be used in operating the transmission line was included in the McGuigan contract. This line is erected on wood poles and follows the roads adjacent to the route of the transmission line, the total mileage of pole line to be constructed being about 281.

The work on the telephone line was begun in Section A, Dundas to Niagara Falls, on April 27th, 1909, and the work has since been carried on continuously, though, as in the case of the transmission line, the progress of the work was hampered by right-of-way trouble.

Up to October 31st, 1909, 171 miles of pole line has been erected in various parts of the system. The mileage of pole line erected in the different sections is as follows: Section A, Niagara Falls-Dundas, 44 miles; Section B, Dundas-Toronto, 29 miles; Sections C and D, Dundas-Woodstock, 22 miles; Section E, Woodstock-London, 7 miles; Section F, Dundas-Guelph, 26 miles; Section G, Guelph-Stratford, 20 miles; Section H, Stratford-London, 23 miles.

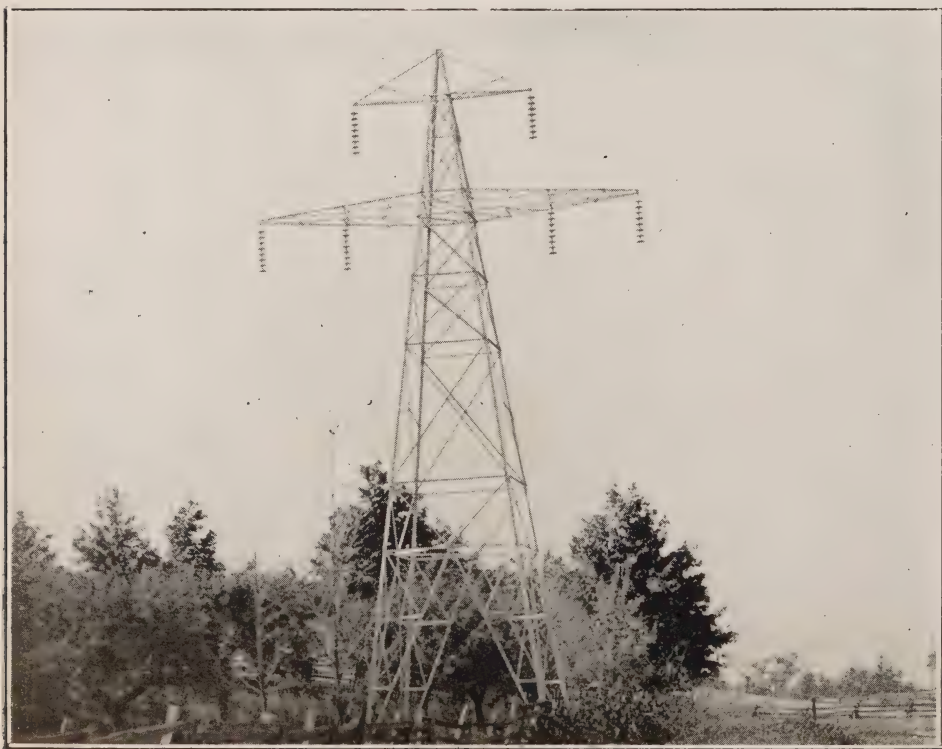
The erection of poles will continue until freezing weather sets in, the intention being to string wire during the winter.

The field work on the telephone and protective system is under the supervision of the Field Engineer in charge of construction, under whom are the Commissioners' telephone line Inspectors.

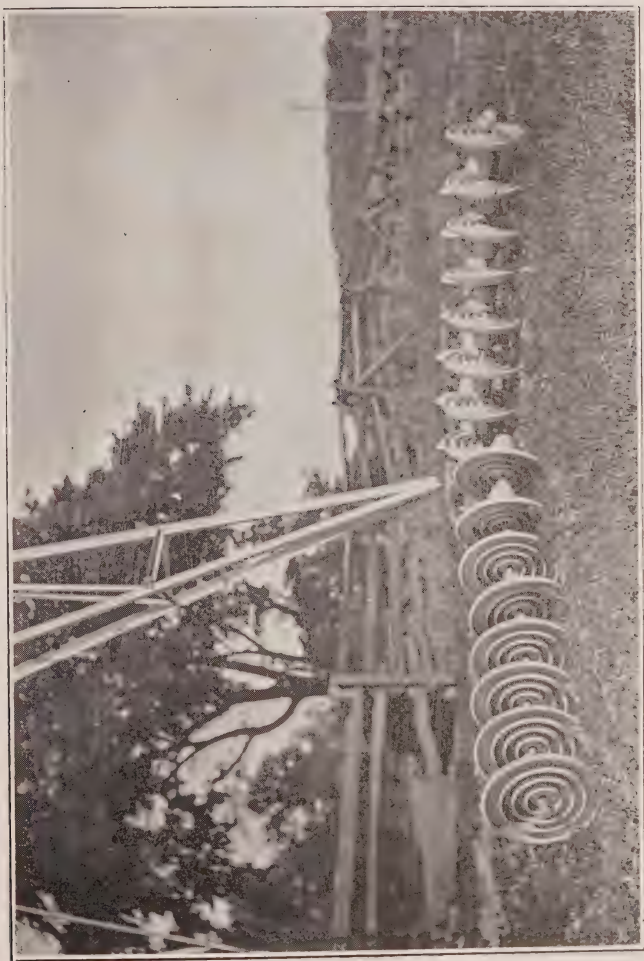
No instrumental surveys were made of the route of the telephone line, the line in the various sections being staked out by the Inspector and the poles numbered consecutively.



Showing Open Base of Standard Tower.



First Tower with Insulators erected. Niagara-Dundas Section.



Insulators on Ground Ready to be Erected on Tower.

## TRANSFORMER STATION CONSTRUCTION.

### LOCATION OF STATION SITES.

In the system at present laid out eleven high tension stations are required, one being in or near each of the following towns or cities: Niagara Falls, Dundas, Toronto, Woodstock, London, Guelph, Preston, Berlin, Stratford, St. Mary's and St. Thomas.

In choosing the sites for these stations the following points were considered:

Provision must be made for the probable requirements of communities within a radius of 12 to 15 miles of the station.

The station should be as near the centre of distribution as practicable without adding materially to the cost of right-of-way, or to the cost of high tension lines.

Provision must be made for the outgoing as well as the incoming lines, it being desirable to have as few angles as possible in either, and to have them enter the buildings at right angles to the walls through which they pass.

Cooling water for the transformers must be easily obtained and the supply must be constant.

The ground must be suitable for carrying a heavy building and must be situated so that it may be readily drained and be entirely free from all danger of floods.

Transportation facilities to and from the station had also to be considered, as well as possible homes for the station attendants within a reasonable distance from the station.

It is believed that the sites as selected are the best local conditions would allow and that they are quite suitable for the use to which they are to be put.

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### STATION BUILDINGS.

The designing staff was increased considerably for the purpose of the preparation of plans for the construction of the step-up transformer station at Niagara, the main interswitching station at Dundas and the interswitching station and step-down transformer stations for the different municipalities.

General designs were prepared, and just as soon as the contracts for electrical equipment were awarded the preparation of detail designs was proceeded with. The electrical apparatus as proposed by the different manufacturers differed to such an extent that it was impossible to design the buildings until it was known what apparatus would be furnished.

A staff consisting of eight designers and draughtsmen proposed plans and specifications for the different buildings. A copy of the Niagara Station specifications is printed below as a sample.

The Commission secured the services of Mr. John M. Lyle, of Toronto, as Consulting Architect, who attended to the architectural features of the buildings and gave his approval of the specifications.

Advertisements were placed in all the daily papers and engineering journals for tenders for these buildings. Copies of these advertisements are printed herewith.



Tenders were called for Niagara and Dundas stations on July 6th, and for the remaining stations, Toronto, London, Guelph, Berlin, St. Mary's, Stratford, Preston, Woodstock and St. Thomas, on July 28th.

The form of tender for Niagara building is produced herewith as a sample.

#### HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO. TENDERS FOR NIAGARA FALLS AND DUNDAS TRANSFORMER STATION BUILDINGS.

Tenders will be received up to 5 p.m., Tuesday, July 6th, 1909, for the construction of—

1. Transformer station building at Niagara Falls, Ontario.
2. Transformer and interswitching station building at Dundas, Ontario.

All according to plans and specifications to be obtained at the offices of the Commission, Continental Life Building, Toronto, Ontario. Complete plans and specifications may be obtained upon a deposit of \$5.00 for each station, which deposit will be promptly refunded upon receipt of tender, or certified cheques to the amounts called for in the "Instructions to Bidders" must accompany each tender.

The lowest or any tender not necessarily accepted.

Tenders must be sealed and addressed to Hon. Adam Beck, Chairman, Hydro-Electric Power Commission, Continental Life Building, Toronto, Ontario.

Papers inserting this advertisement without authority will not be paid for same.

#### HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO. TENDERS FOR TRANSFORMER AND INTERSWITCHING STATION BUILDINGS.

Tenders will be received up to 5 p.m., Wednesday, July 28th, 1909, for the construction of Transformer and Interswitching Station Buildings at Toronto, London, Guelph, Preston, Berlin, Stratford, St. Mary's, Woodstock, Paris and St. Thomas, all according to plans and specifications to be obtained at the offices of the Commission, Continental Life Building, Toronto, Ontario.

Plans and specifications may be obtained upon a deposit of \$5 per individual set, or \$15 for the complete set, which deposit will be promptly refunded upon receipt of tender, or the return of plans and specifications.

Certified cheques to the amounts called for in the "Instructions to Bidders" must accompany each tender.

The lowest or any tender not necessarily accepted.

Tenders must be sealed and addressed to Hon. Adam Beck, Chairman, Hydro-Electric Power Commission, Continental Life Building, Toronto, Ontario.

Papers inserting this advertisement without authority will not be paid for same.

#### INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION OF TRANSFORMER STATION BUILDING, NIAGARA FALLS.

1. Tenders will be received up to 5.00 p.m., Tuesday, July 6th, 1909, by the Hydro-Electric Power Commission of Ontario for the supply of materials, and for the construction of all works and performance of all labor involved in the construction of the transformer station building near Niagara Falls, all according to the drawings and specifications attached hereto.

2. Each tender shall be enclosed in a sealed envelope marked "Tender for the Construction of Transformer Station Building near Niagara Falls," and addressed to the Hon. Adam Beck, Chairman of the Hydro-Electric Power Commission of Ontario, Toronto, Canada.

3. The signature of parties tendering must be in their respective handwriting.

4. Tenderers must make themselves personally acquainted with the site of works, with the nature of the materials to be handled, with the conditions existing in the locality, and with all items which can enter into the cost of the work to the Contractor.

5. Persons tendering must satisfy the Commission of their ability to furnish the materials and perform the work for which they tender.

6. Tenders shall be submitted on the accompanying "Form of Tender," and with Bill of Materials properly filled out. Any tenders offered on other forms, or with erasures or alterations, may be rejected as informal.

7. The tenderer may attach to the "Form of Tender" additional alternative tenders for the works specified, based on the alternative type of construction as covered by the specifications. All such alternative bids shall be arranged in a manner similar to the attached "Form of Tender," in order that the Engineer may make a proper comparison of tenders.

8. Each tender must be accompanied by these Instructions to Bidders, "General Specifications for Material, etc.," "Specifications for Step-up Transformer Station Building, Niagara Falls," and "General Conditions of Contract," with the plans and drawings accompanying the specifications, all of which shall form a part of the contract to be entered into by the successful tenderer.

9. Each tender shall be accompanied by a certified cheque for Two Thousand Five Hundred Dollars (\$2,500), which certified cheque shall be forfeited to the Commission as liquidated damages in event of the successful tenderer failing to execute the necessary contract herein referred to within two weeks after notification to him from the Commission to do so. Cheques shall be returned to the respective bidders by the Commission, upon the awarding and execution of the contract as aforesaid, or at any rate within sixty days from the date of the opening of bids.

10. The successful tenderer will be required to execute a satisfactory bond in an amount equal to twenty-five per cent. (25%) of the contract price, for the proper performance of the work embraced by the contract.

11. The Commission reserves the right to reject any or all tenders, or to accept any tender which shall appear advantageous to them. The lowest or any tender will not necessarily be accepted.

Dated at Toronto, June 15th, 1909.

HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO. FORM OF TENDER FOR  
CONSTRUCTION OF TRANSFORMER STATION BUILDING, NIAGARA FALLS.

....., the undersigned, hereby offer the Hydro-Electric Power Commission of Ontario to furnish all the necessary materials, labor, tools, machinery and other plant, to execute and complete in a satisfactory and workman-like manner all the works required in connection with the construction of the Transformer Station Building near Niagara Falls, Ontario, complete, with the exception of all work and materials under Section No. 25 of Niagara Station Specifications, "Bus, Switch and Wiring Compartments," according to the plans and

specifications submitted to ..... for the sum of .....  
 .....dollars (\$ .....), and agree to the following unit  
 price in case of additions to, or deductions from, the amounts as indicated on the  
 drawings, or called for in the specifications:

Excavation, including necessary back filling:

For foundations and under building .....per cubic yard \$  
 For sewer and pipe trenches outside of building..... " " " \$

Concrete, including forms and reinforcement:

" Mass " concrete 1-3-5 in foundations, columns and  
 walls . . . . . " " " \$  
 6-inch reinforced floors .....per square foot \$  
 5-inch reinforced floors ..... " " " \$  
 3-inch reinforced floors or roof, including grading.. " " " \$  
 Lintels in place in superstructure .....per cubic foot \$  
 2-inch partitions, including studding ..... " square " \$  
 Hood curtains, including moulding ..... " " " \$  
 Ground floors, including tamping and sub-base .... " " " \$  
 Cement and plaster ceiling (over control gallery).... " " " \$

Brickwork—in place:

No. 2 pressed brick .....per M. brick \$  
 Stock brick ..... " " " \$

Cut stone work—in place:

Bearing stones for steel work .....per cubic foot \$  
 Key stones ..... each \$  
 Window sills—2-course .....per lineal foot \$  
 Window sills—3-course ..... " " " \$

Terra cotta—in place, including anchors:

Cornice—measured on face ..... " " " \$  
 Coping—measured on face ..... " " " \$

Structural steel in place, painted .....per pound

Steel reinforcement in 1-3-5 concrete ..... " " \$

Anchor bolts, in place ..... " " \$  
 Checkered steel stairway treads and sheet iron risers, in  
 place, with fastenings .....per pound \$

Rails, with plates, bolts and fastenings, in place..... " " \$

Glazed sewer pipe, in place, including fittings:

4-inch .....per lineal foot \$  
 6-inch ..... " " " \$  
 8-inch ..... " " " \$

4-inch agricultural drain pipe, in place ..... " " " \$

Cast iron conductor and drain pipe, in place .....per pound \$

Cast iron conductor and drain fittings, in place..... " " \$

Railings, two, 1½-inch pipes, in place, with posts painted  
 complete . . . . .per lineal foot \$

Iron doors with frames, erected, painted, including hinges  
 and hasps .....per pound \$

6-ply gravel roofing, in place .....per square yard \$

Galvanized iron flashing, in place .....per square foot \$

1 enamelled porcelain water closet installed complete as per specifications \$

1 washstand as specified, installed ..... \$

## Painting:

Walls, woodwork, sheet metal, iron pipes, etc. ....	per square yard	\$
Concrete floor filler, in place .....	" " "	\$
Floors .....	" " "	\$

Waterproofing walls .....	" " "	\$
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Duct (electrical), in place .....	per duct foot	\$
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## Windows—in place, painted and glazed:

Metal, with rough wire glass .....	per square foot	\$
Metal, with double diamond glass .....	" " "	\$
Extra, per ventilator .....	each	\$

.....		\$
.....		\$
.....		\$
.....		\$
.....		\$
.....		\$
.....		\$
.....		\$

..... herewith submit the following Bill of Materials, as that upon which the above proposal is based.

## Excavation:

For foundations and under building .....	cubic yards.
For sewer and pipe trenches outside building .....	" "

## Concrete:

1-3-5-inch foundations, columns, steps and walls....	" "
6-inch reinforced floors .....	square feet.
5-inch reinforced floors .....	" "
3-inch reinforced floors and roof .....	" "
Lintels .....	cubic feet.
2-inch partitions (in building) .....	square feet.
Hood curtains, including mouldings .....	" "
Ground floors .....	" "
Cement and plaster ceiling .....	" "
Parapet coping .....	cubic feet.

## Brickwork:

No. 2 pressed brick .....	M. brick.
Stock brick .....	"

## Cut stone work:

Bearing stones .....	
Key stones .....	
Window sills—2-course .....	lineal feet.
Window sills—3-course .....	" "

## Terra cotta:

Cornice—measured on face .....	" "
Coping—measured on face .....	" "

Structural steel .....	pounds.
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Checkered plate and risers for stairs .....	"
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Rails and fastenings .....	"
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Iron doors and frames .....	"
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Pipe railings .....	lineal feet.
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Steel reinforcement in 1-3-5 concrete .....	pounds.
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Anchor bolts .....	"
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4-inch . . . . .	lineal feet.
6-inch . . . . .	“ “
8-inch . . . . .	“ “

Cast iron pipe ..... pounds.

Cast iron pipe fittings .....	“
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Gravel roofing ..... square yards.

Galvanized iron flashing ..... square feet.

Walls, woodwork, sheet metal, iron piping, etc., single

coats . . . . . square yards.

Concrete floor filler .....	“	“
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Floors . . . . . “ “

Waterproofing walls .....	“	“
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Ducts (electrical) ..... duct feet.

As per specifications.

As per specifications.

.....further offer to deduct from the above proposal the amount of

Dollars (\$ ) if the alternative wall construction as shown on Drawing 3—S—1016 is decided upon, in which case the following amounts of materials shall be substituted for like materials in the above Bill of Materials:

No. 2 pressed brick .....	M. brick
Stock brick .....	"

Cornice . . . . .	none.
Coping . . . . .	none.

Coping . . . . .	cubic feet.
Concrete parapet coping . . . . .	

Concrete parapet coping . . . . .

.....further offer to furnish material for, construct and erect such slabs, walls, etc., as are required for switch, wiring and bus compartments at the following prices, all according to the specifications, providing the contract for the building is let to . . . . .

Concrete, including reinforcement, surfacing, painting:

1½-inch slabs .....	per square foot	\$
2-inch slabs .....	" "	\$
3-inch slabs .....	" "	\$

Blocks, 1-2-3 mixture .....per cubic foot \$  
Walls, 1-2-3 mixture ..... " " " \$  
Walls, 1-3-5 mixture ..... " " " \$  
Steel supports, fittings, bolts, in place, painted .....per pound \$  
.....further offer to do any grading around the building for the  
cost of the labor plus per cent. ( %).

..... hereby offer and agree should the Contract be let to.....  
to complete the entire work and hand it over to the Commission ready for use  
within..... months after the date of notification from the Engineer to  
begin work.

.....further hold ..... ready to enter into a con-  
tract in form satisfactory to the Commission for the due and proper execution of  
the work at the rates and on the terms herein stated, and .....  
further agree to furnish security for the due performance of the contract in a  
bond for ..... Dollars (\$ ), with satisfac-  
tory sureties, as specified.

.....herewith enclose an accepted bank cheque, payable to the order  
of the Chairman of the Hydro-Electric Power Commission of Ontario, for the sum  
of Two Thousand Five Hundred Dollars (\$2,500.00), as required in the "Instruc-  
tions to Bidders," dated June 15th, 1909.

.....hereby certify that ..... have carefully investigated  
all conditions and the items of cost which may or can possibly enter into the cost of  
the work to .....

Signed.....

Post Office Address .....

.....

.....

.....

Dated .....

In answer to the advertisements, the following tenders were received for the  
construction complete of the transformer and interswitching station buildings:



After due consideration of the merits of the different tenders the following contracts were finally awarded:

Niagara Falls Station.....	John Hayman & Sons, London Ont.
Dundas Station .....	John Hayman & Sons, London, Ont.
Toronto Station.....	Witchall & Son, Toronto.
London Station.....	Hyatt Bros., London.
Guelph Station.....	Edge and Gutteridge, Seaforth.
Berlin.....	" " "
St. Mary's... ..	" " "
Stratford.....	" " "
Preston.....	John Hayman & Sons, London.
Woodstock.....	" " "
St. Thomas.....	" " "

Construction commenced on most of the buildings shortly after the contracts were awarded. Reproductions of photographs taken recently show the progress of the work on different buildings.

The staff, whose duties consisted in attending to station construction, consisted of an engineer in charge of the general work, one who made an inspection of each building once a week, one inspector in charge of each station, and two designers and four draughtsmen constantly employed in the office preparing details as the work progressed.

It is highly probable that the buildings at Niagara Falls, Dundas, Toronto, Guelph, Berlin and Preston will be under cover before the severe weather sets in, and that the others will be so far advanced by the coming winter that it will be possible to continue work on same all winter.

### ELECTRICAL EQUIPMENT.

Although tenders had been received during the year 1908 for the supply of electrical equipment, the contracts for same were not awarded until the spring of the present year.

Owing to the pioneer nature of the work (transmission of power at 110,000 volts) the Commission deemed it advisable, before awarding contracts, to consult eminent engineers conversant with power transmission. The services of Mr. Ralph D. Mereshon, of New York City; Mr. Robt. A. Ross, of Messrs. Ross and Holgate, Montreal; and Mr. V. Y. Converse, of Niagara Falls, were obtained.

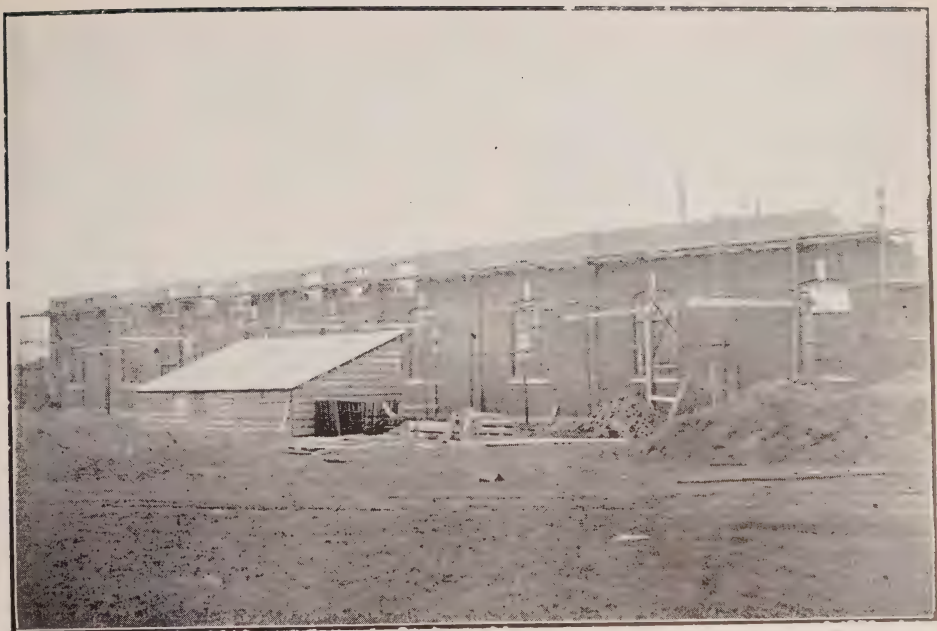
Visits were made to the works of the General Electric Company at Schenectady, N.Y., and of the Westinghouse Company at Pittsburg, for the purpose of witnessing tests on apparatus similar to that which the different companies proposed furnishing.

After the merits of the different tenders were carefully considered, the Commission entered into contracts with different companies as follows:

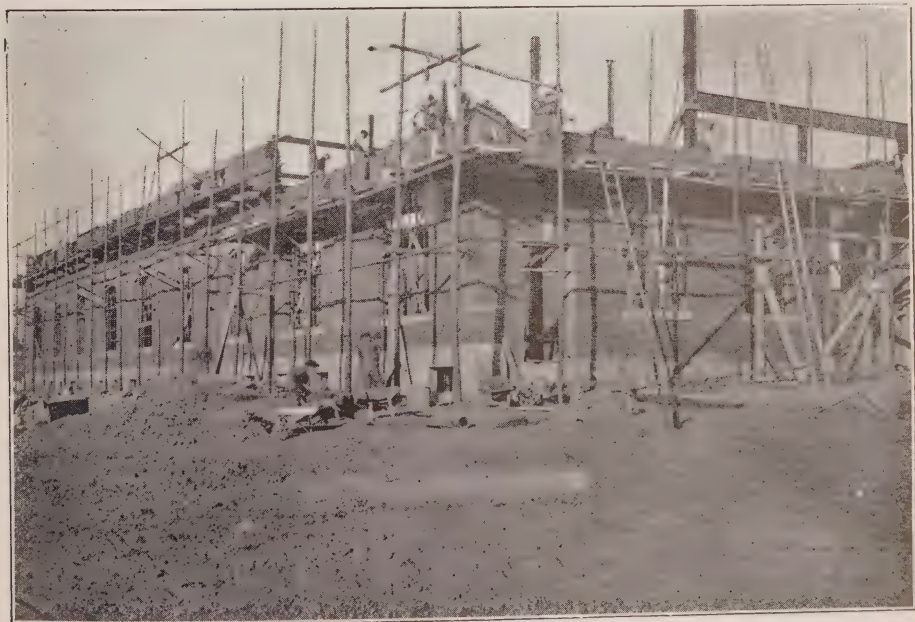
(a) With the Canadian General Electric Company, for the supply and installation of the necessary equipment for the stations at Toronto, London, Guelph, Preston, Berlin, Stratford, St. Mary's, Woodstock and St. Thomas, with the exception of the 110,000 volt line switches.

(b) With the Canadian Westinghouse, for the supply and installation of the 110,000 volt line switches in the stations just mentioned, of the complete equipment for Niagara Falls and Dundas stations, and of a protective relay system whereby defective portions of the transmission lines will be automatically cut out without disconnecting the supply of power at any distributing point of the system.



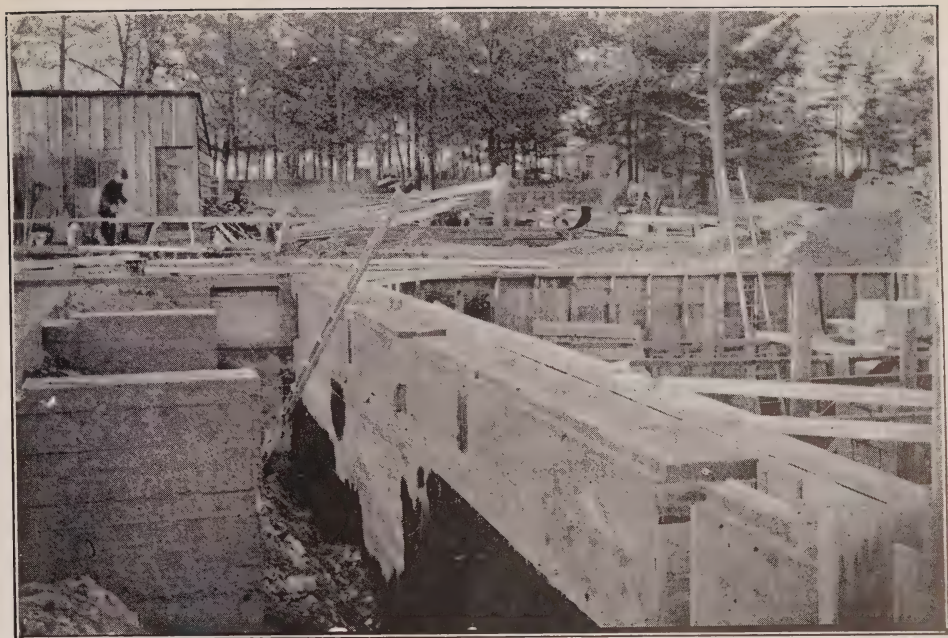


Dundas Station. October 16th, 1909.



Niagara Station. November 6th, 1909.





London Station, October 27th, 1909. Piping Subway.



Guelph Station. November 9th, 1909.





The work of construction of the electrical apparatus is advancing in the factories of the different contractors at such a rate as to warrant its completion by the different dates mentioned in the contracts. Work of installation will commence as soon as the different buildings are under cover.

A resident inspector has been appointed at each manufacturing point, whose duty it is to keep constantly in touch with the work in the shops. In addition to this, when any special tests have been performed, an engineer has been present from the office.

The contracts for the electrical equipment are printed herewith. The wiring diagram for each station is shown on the following pages, and also a sample plan and elevation of a station showing layout of apparatus.

THIS AGREEMENT, dated the 26th day of May, 1909,

BETWEEN CANADIAN GENERAL ELECTRIC COMPANY, LIMITED (hereinafter called the Contractor), Party of the First Part, and HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO (hereinafter called the Commission), Party of the Second Part,

WITNESSETH that the parties covenant, promise and agree each with the other as follows:

The following documents:

- (a) Commission's "Specifications for Electrical Equipment, Toronto, London, Guelph, Preston, Berlin, Stratford, St. Mary's, Woodstock, and St. Thomas stations (Line Oil Switches and Relays omitted)" (99 pages), marked "A."
- (b) Drawings accompanying Commission's Specifications (12 drawings) marked "B."
- (c) General conditions of Contract (11 pages), marked "C."
- (d) Contractor's "Specifications for Switchboard" (36 pages), and "Specifications for Transformers" (    pages), marked "D."
- (e) Prints of Contractor's Drawings when initialed as approved by Engineer, marked "E."
- (f) Contractor's Bond, marked "F."
- (g) Schedule of Prices, marked "G."

shall form part of this contract.

The Contractor agrees:—

1. To furnish, install and test, for stations at or near Toronto, London, Guelph, Stratford, St. Thomas, Woodstock, Berlin, St. Mary's and Preston, the electrical equipment set forth in detail in the said plans, specifications and drawings.

2. To use the best material and construct and install equipment in a thorough workmanlike manner, in strict conformity with said plans, specifications and drawings, to the satisfaction of the Commission's Chief Engineer.

3. To fully complete and deliver to the Commission the said equipment at the following dates:—

- (a) To use every means within the Contractor's power to complete, according to this contract, on or before the 19th December, 1909, a bank of three transformers and a spare transformer, with all necessary switches for Toronto station, and all transformers, switches, and apparatus, necessary for the stations at Guelph, Berlin and Preston.

- (b) To complete the equipment set forth in 3 (a), on or before the 15th March, 1910.
- (c) To use every means within the Contractor's power to complete, according to this contract, on or before said 15th March, 1910, the stations at Toronto, London, Guelph, Preston, Berlin, Stratford, St. Thomas, St. Mary's and Woodstock.
- (d) To complete the stations set forth in 3 (c) on or before the 19th May, 1910.
- (e) If any of the said equipment set forth in 3 (a) should become defective prior to the 15th March, 1910, and if any of said equipment set forth in 3 (c) should become defective prior to the 19th May, 1910, the Contractor shall forthwith, without any delay, use every means within the Contractor's power to replace the said defective equipment.
- (f) The Contractor shall be liable for damages for breach of contract to use every means in the Contractor's power to complete the said equipment in 3 (a) on or before the 19th December, 1909, and for breach of contract to replace the said equipment as provided in 3 (e).
- (g) Except as provided in 3 (e) and (f), the Contractor shall not be liable for breach of contract in respect of the said equipment set forth in 3 (a), committed prior to the 15th March, 1910, nor for breach of contract in respect of the said equipment set forth in 3 (c), committed prior to the 19th May, 1910.
- (h) Prior to the said 15th March, and 19th May, 1910, the Contractor shall be liable for breach of contract in respect of the said equipment and otherwise, as set forth in 3 (e), and, after said dates, the Contractor shall be liable as provided in other paragraphs of this contract.

4. To deliver to the Commission a Bond, satisfactory to the Commission, to secure the sum of Sixty Thousand Dollars (\$60,000), for the proper performance of the contract. It shall be provided in said Bond that, without notice to the Surety, the said documents and this contract, or any part or parts thereof, may, from time to time, be varied, and that the said Surety shall not be released or the liability under the Bond affected by any such variations.

5. If any delay is caused by breach of this contract, the damages, when ascertained, shall not exceed \$10,000 for the first month, \$20,000 for the second month, and \$30,000 for the third month. At the expiration of the third month, the Contractor shall be liable for damages for breach of contract as provided in other paragraphs of this contract. Damages for breach of contract for any part of the said months shall not exceed a proportionate part of the said sums. The said sums are respectively to be deemed maximum but unliquidated damages.

6. On or before the 1st January, 1910, upon request in writing, to enter into a further contract upon the terms hereof, except as to time of completion, which shall be a reasonable time to be fixed by the said Engineer, to supply any spare and additional equipment that may be required for the said nine stations, and if required by the Commission for stations at or near Brantford, Chatham, and Windsor, at prices set forth in said schedule of prices.

7. On or before the 1st January, 1912, upon request in writing, to enter into a further contract to supply, at the prices set forth in said schedule of prices, together with the increase (if any), in cost for copper and labor, all regular and spare electrical equipment, if required by the Commission, for stations at or near Brantford, Chatham, and Windsor.



Berlin Station. November 3rd, 1909.



St. Mary's Station. November 4th, 1909.







Preston Station. October 21st, 1903.



Stratford Station. November 10th, 1909.



8. The Bond to be delivered for either or both of said further contracts shall be 25 per cent. of the amount thereof.

9. The Commission agrees:—

- (a) The Engineer shall, pursuant to paragraph 14 (a) of the General Conditions, give his order to the Contractor to proceed with the works, as soon as possible, and not later than the 1st of June, 1909.
- (b) To pay to the Contractor, for said equipment, upon the terms and conditions set forth in the said General Conditions and Specifications the amounts set opposite the name of the said stations as follows:—

Toronto Alternative	.\$65,503	St. Thomas	.....\$26,775
Toronto	..... 77,704	Woodstock	..... 40,210
London	..... 49,422	Berlin	..... 46,030
Guelph	..... 34,046	St. Mary's	..... 34,046
Stratford	..... 34,046	Preston	..... 42,467

10. It is further agreed:—

- (a) That the Contractor will, within a time specified in writing by the said Engineer, supply the Commission with data and details of all electrical characteristics for the said equipment, and the Commission will, upon request in writing, supply the Contractor with such data and details of electrical power and equipment to be supplied to the Commission by any other Contractor or parties.
- (b) If the Contractor does not, in the opinion of the said Engineer, carry on the works with sufficient speed to complete the work at said dates, the Commission may, at its option, be released from this agreement, and the Contractor shall, upon notice in writing, immediately discontinue the works, and if required by the said Engineer, the Contractor shall immediately remove the whole or any part of the said equipment, to be specified by the Engineer, that has been delivered to the Commission, and the Commission may, at its option, proceed with the said works. The Commission shall not be liable for any loss, costs or damage arising before or after the release of the Commission from this agreement.
- (c) All the rights and remedies of the Commission and of the Engineer, acting on their behalf, may be exercised and continued concurrently or in the alternative.
- (d) If within twelve months from the date of the final certificate of the Engineer, it appears that unsound or defective material has been used by the Contractor, or the said works have not been executed in a substantial, workmanlike and proper manner, the Contractor shall be liable to the Commission for all damages arising therefrom. No certificate, payment, or other act, matter or thing, done or omitted, under this contract, shall bar or prejudice the rights of the Commission in this respect.
- (e) Time shall be of the essence of this agreement.
- (f) For all purposes of this contract, notices shall be served upon the Engineer, or his appointee, in writing, for the Commission, and upon the Manager, or his appointee, in writing, for the Contractor.



- (g) In case any municipal corporation, which shall contract with the Commission for a supply of power, or any person, firm, or corporation, which shall contract with any such municipal corporation, or with the Commission, for a supply of power, shall suffer damages by breach of this contract by the Contractor, and such municipal corporation, firm, person, or corporation, would, if the Contractor had made this contract directly with them, have had a right to recover such damages, or commence any proceedings, or any other remedy, the Commission shall be entitled to commence any such proceedings, or bring such action for, or on behalf of, such municipal corporation, person, firm, or corporation, and notwithstanding any acts, decision, or rule of law to the contrary, the Commission shall be entitled to all the rights and remedies of such municipal corporation, person, firm, or corporation, including the right to recover such damages, but no action shall be brought by the Commission until such municipal corporation, person, firm, or corporation shall have agreed with the Commission to pay any costs that may be adjudged to be paid. The rights and remedies of any such municipal corporation, person, firm or corporation, shall not be hereby prejudiced.

11. The Contractor shall not be liable for damages for breach of contract caused by any delay of the Commission, and neither party shall be liable for damages for breach of contract caused by strikes, lock-outs, accidents, riots, fires, explosions, acts of God, war, the delay of any other contractor, or any other cause reasonably beyond its control, and should any delay in the performance of this contract be caused to either party thereby, the Contractor shall not be bound to deliver <sup>or</sup> the Commission shall not be bound to accept equipment during such time and the time for performance of this contract by both parties shall be correspondingly extended. Provided that the Contractor shall not be exonerated from such damages, nor entitled to have the time extended if when the delay of the Commission and of any other Contractor happened the Contractor had not performed so much of his contract as the Commission was then entitled to.

Provided further that the parties shall be prompt and diligent to remove the cause or causes of interruption, in so far as they are able, and when such interruption shall have ceased the parties shall be prompt and diligent to perform the contract.

Provided that in construing this paragraph the rule of law known as *ejusdem generis* shall not be applied.

12 (a) If any difference shall arise during the progress or after the completion of the works, as to any matter or thing arising under or out of this contract, such difference shall be referred to two arbitrators, one to be chosen by each of the parties hereto, and they shall choose a third arbitrator; but, if they cannot agree, such third arbitrator shall be chosen by the Chief Justice at the time of the King's Bench Division of the High Court of Justice. When possible, the arbitrators shall decide such difference in a summary manner. Either party may appeal from any award of the arbitrators, as provided by the Arbitration Act, R.S.O. Chap. 62, but no such appeal shall be carried beyond the decision of the Court of Appeal of Ontario.

- (b) The arbitrators shall not consider any matter or difference which is expressly, or by implication, required, or permitted to be decided by the Engineer, or as to the grounds upon which, or mode in which, any



Lighting Arrester  
Disconnecting Switches (DS)

Cutout Coils  
Series Transformer (ST)  
Line Oil Switch (OS)

Series Relays (SR)

DS

HT Bus Bars

DS

SR

Transformer OS

Transformers

DS

DS

ST

OS

DS

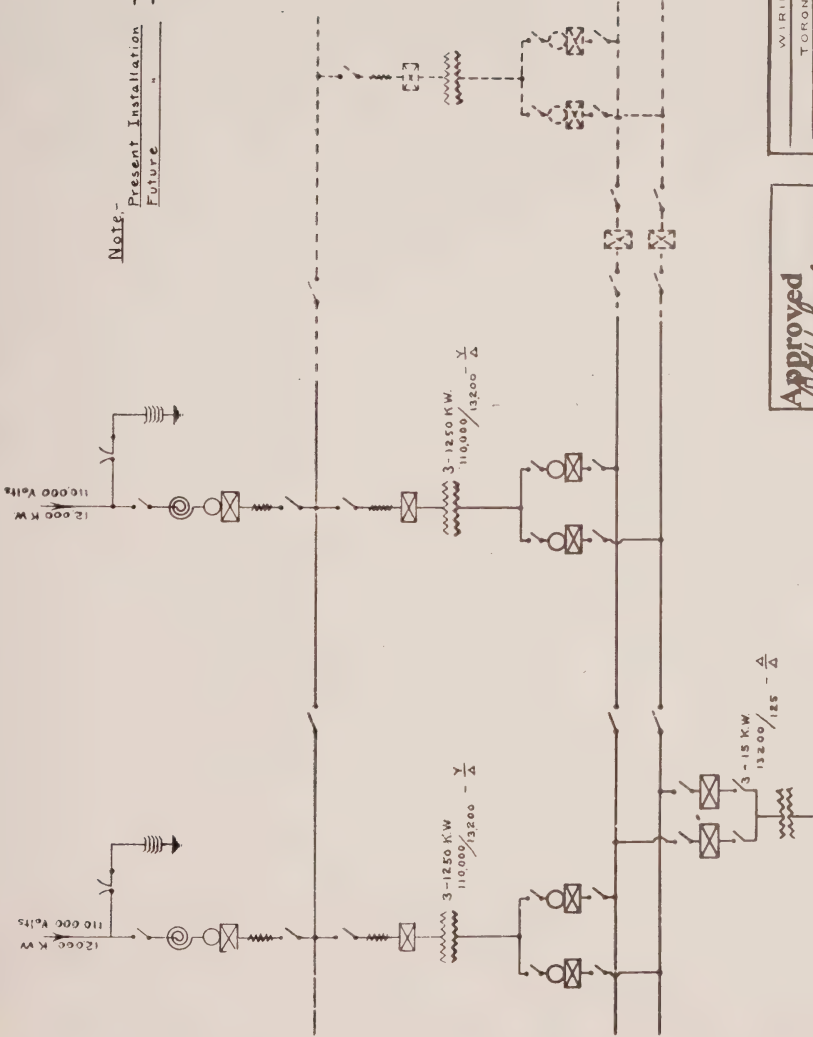
LT Bus Bar No. 1

LT Bus Bar No. 2

DS

Service OS

Service Transformers



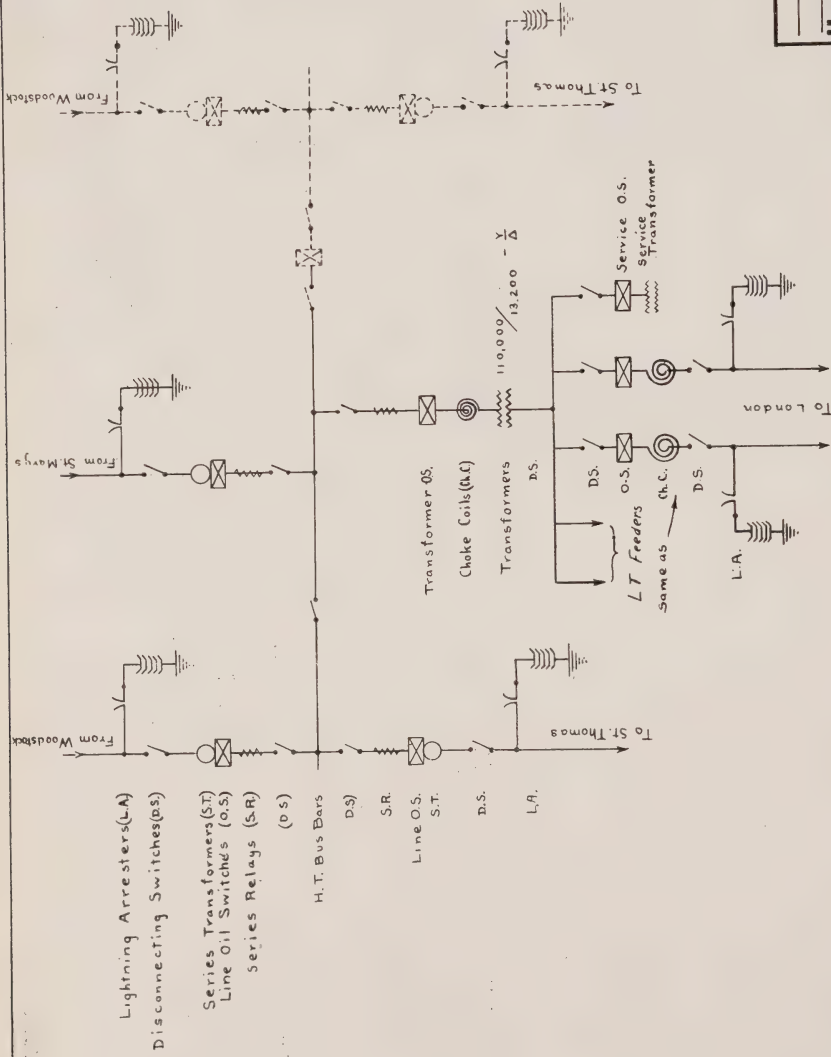
NOTE -  
Present Installation  
Future

Approved  
*W. McArthur*  
Chief Engineer.

WIRING DIAGRAM (ALTERNATIVE)  
TORONTO STATION

HYDRO-ELECTRIC POWER COMMISSION  
OF ONTARIO

Scale: Toronto, 1/4" = 1' 1900  
Drawn by: E.I.B. 1944  
Checked by: J.G. 1944  
NO. 2-S-43



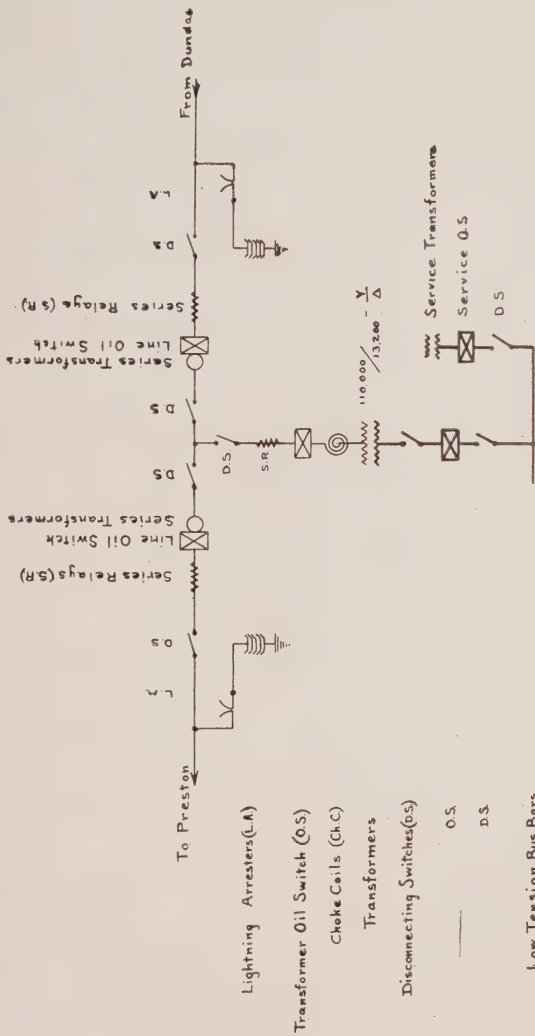
Note-  
Present Installation  
Future

WIRING DIAGRAM  
LONDON STATION

HYDRO ELECTRIC POWER COMMISSION  
OF ONTARIO

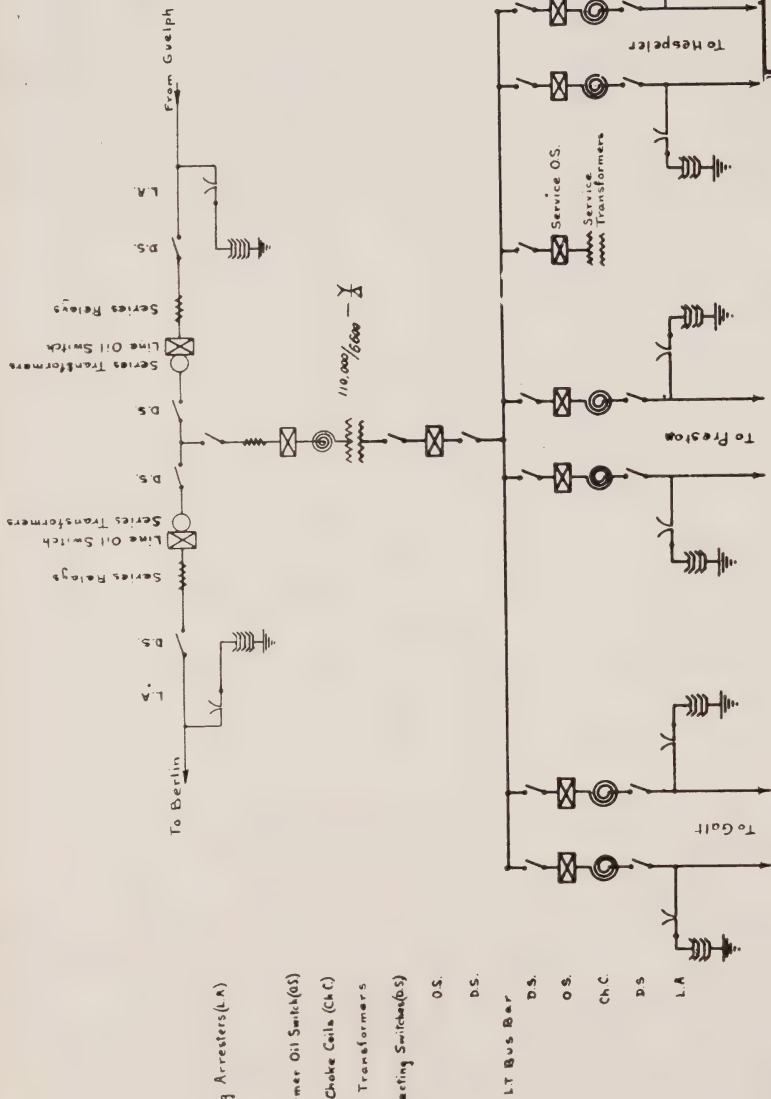
Scale. \_\_\_\_\_  
Drawn by *J. S.* Checked by *E. F. B. M.*  
Toronto, Mar 15<sup>th</sup> 1909  
NO. 2544

P.W. SOTTMAN  
Chief Engineer.



Approved  
*W. J. McManis*  
 Chief Engineer

WIRING DIAGRAM  
 GUELPH STATION  
 HYDRO-ELECTRIC POWER COMMISSION  
 OF ONTARIO  
 Scale \_\_\_\_\_ Toronto, Mar. 14, 1909  
 Checked by \_\_\_\_\_  
 Drawn by *G. E. B. 1911* *slr* NO. 2-S-45



Approved  
*W. J. McArthur*  
 Chief Engineer

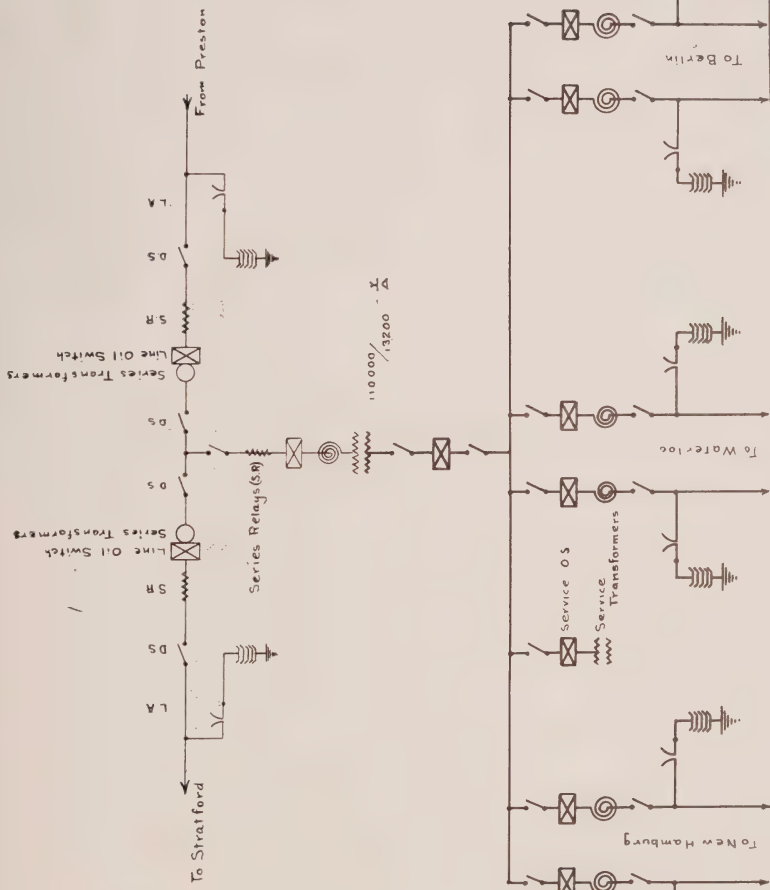
WIRING DIAGRAM  
 PRESTON STATION

HYDRO-ELECTRIC POWER COMMISSION  
 OF ONTARIO

Toronto, Mar. 1st 1909

Scale  
 Drawn by  
 E. T. B. 10/1/09  
 Checked by  
 J. H. NO. 25-46





Lightning Arresters (L.A.)

Transformer Oil Switch (O.S.)

Choke Coils (Ch.C.)

Transformers

Disconnecting Switches (D.S.)

O.S.

D.S.

Low Tension Bus Bars

p.s.

O.S.

Ch.C.

D.S.

L.A.

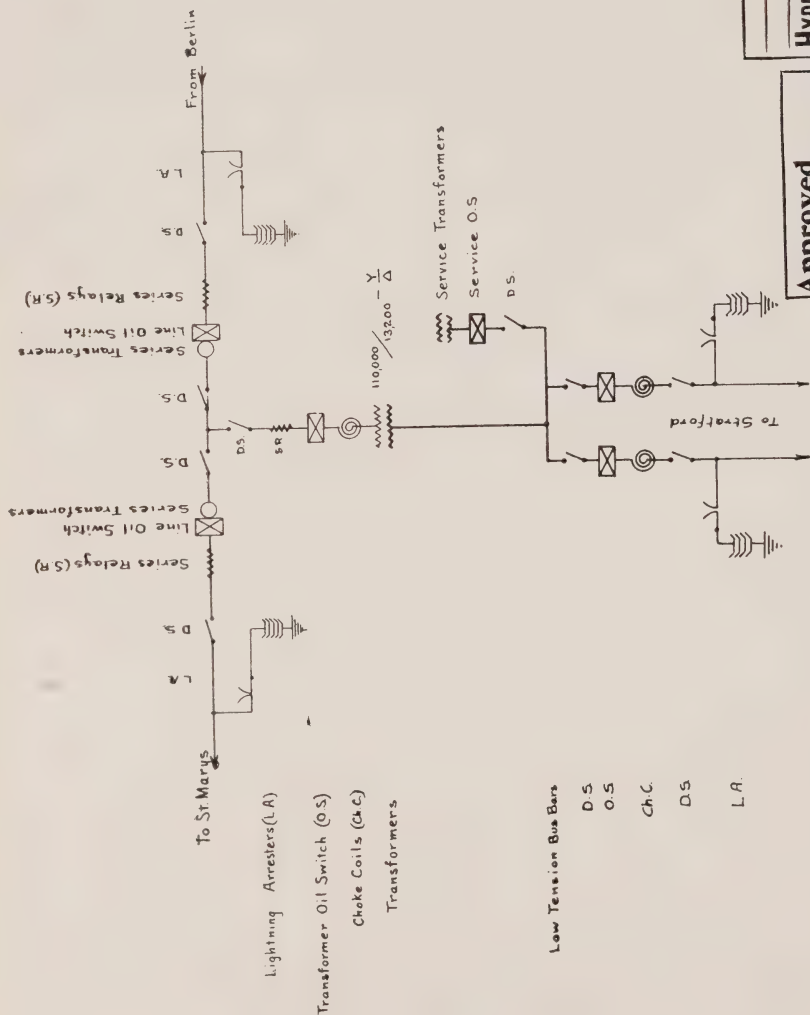
P. W. SOTHMAN  
Chief Engineer

WIRING DIAGRAM  
BERLIN STATION

**HYDRO-ELECTRIC POWER COMMISSION**

OF ONTARIO

Booklet  
Drawn by J. B.  
Checked by E. P. 1/2/22  
Toronto, Mar. 15, 1909  
NO. 2547



WIRING DIAGRAM

STRATFORD STATION

HYDRO-ELECTRIC POWER COMMISSION  
OF ONTARIO

Scale: Toronto, Mar. 1932 1905

Drawn by: E. J. B. 1934

Checked by:

NO. 2548

Approved  
*E. J. B.*  
Chief Engineer.

Low Tension Bus Bars

D.S.

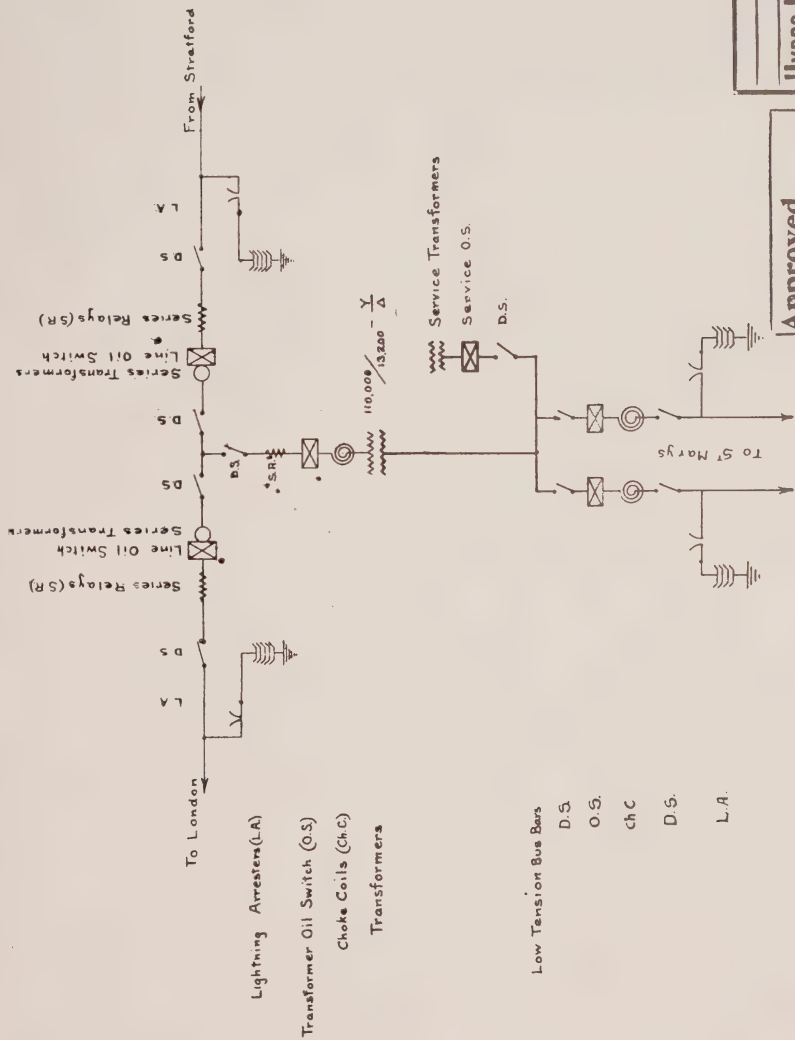
O.S.

C.C.

D.S.

L.A.

Revised Aug 11<sup>th</sup> 09 - 13200 V Feeders (L)



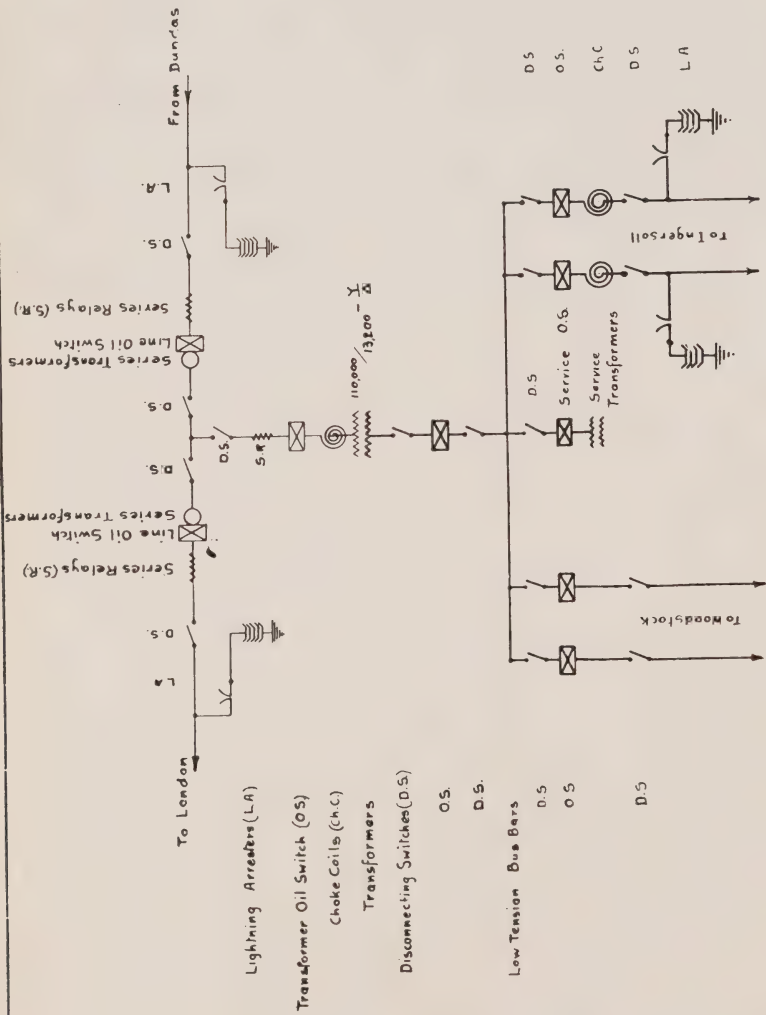
Revised Aug 17<sup>th</sup> 09. - 13200 V Feeders (R).

Approved  
W. McManis  
Chief Engineer

WIRING DIAGRAM  
ST. MARYS STATION

HYDRO-ELECTRIC POWER COMMISSION  
OF ONTARIO

Scale  
Drawn by  
J.S.  
Checked by  
J.S.  
Toronto, Mar. 1<sup>st</sup> 1909  
9484 NO. 2 S 49



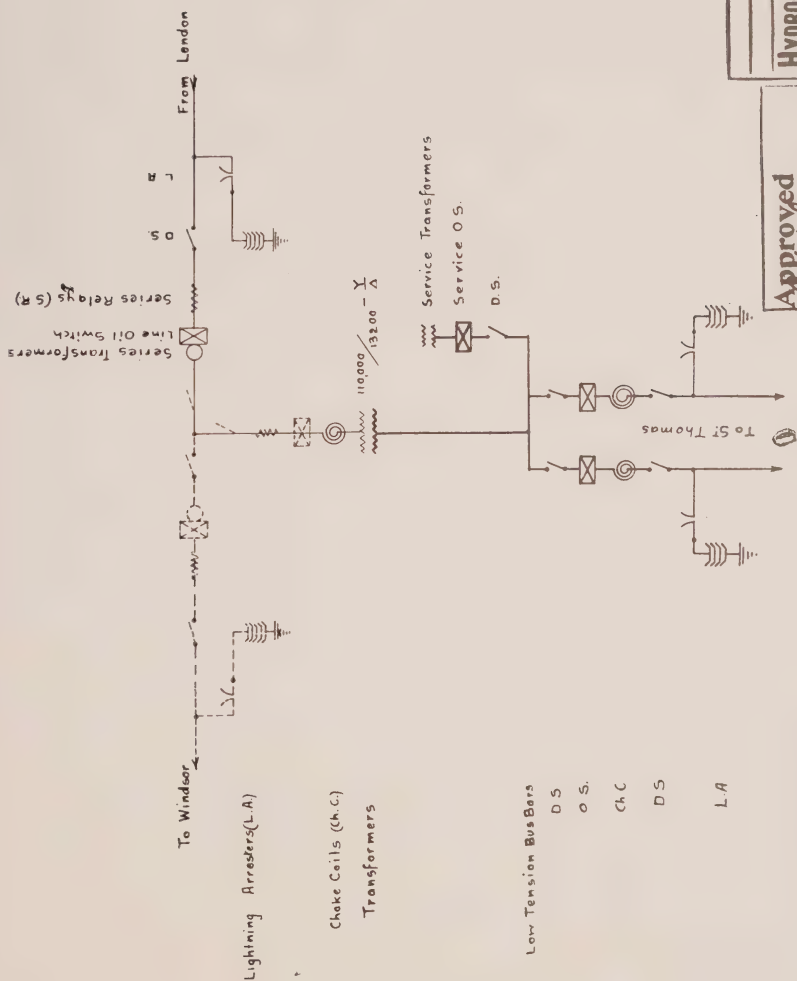
Approved  
*W. J. McManis*  
 Chief Engineer.

WIRING DIAGRAM  
 WOODSTOCK STATION  
**HYDRO-ELECTRIC POWER COMMISSION**  
 OF ONTARIO

Scale: \_\_\_\_\_  
 Drawn by: *J. A.*  
 Checked by: *E. J. O. 1947*  
 Toronto, Mar. 11<sup>th</sup> 1909  
**NO. 2550**

Revised Aug 17<sup>th</sup> 04 - Woodstock Feeders (A).





Note -

Present Installation

Future Installation

Revised Aug 17<sup>th</sup> '09 - 13,200 V Feeders 4, 5, 6

Approved  
W. J. McLaughlin  
Chief Engineer

WIRING DIAGRAM  
SF THOMAS STATION

HYDRO-ELECTRIC POWER COMMISSION  
OF ONTARIO

Scale  
Drawn by  
Checked by  
S. J. G. 1909

Toronto, March 1<sup>st</sup> 1909  
544  
NO. 2 S-51.



opinion may have been formed or discretion exercised, by the Engineer. If any such matter or difference shall arise, and the Contractor claims that such matter or difference should be determined by arbitrators, the Contractor may apply in writing to the Commission, to waive this paragraph 12 (b): thereupon the Commission shall appoint a time and place to hear any representations of the Engineer or Contractor, and the Commission may, in its sole discretion, waive the provisions of this paragraph 12 (b), and permit the said matter or difference to be referred under paragraph 12 (a) to said arbitrators.

13. This agreement shall extend to, be binding upon, and enure to the benefit of the successors and assigns of the said parties.

IN WITNESS WHEREOF the Commission and the Contractor have respectively affixed their corporate seals and the hands of their proper officers.

Canadian General Electric Company, Limited.

H. P. DWIGHT, *Vice-President.*

H. G. NICHOLLS, *Secretary.*

[Seal]

Hydro-Electric Power Commission of Ontario.

A. BECK.

JOHN S. HENDRIE.

W. K. McNAUGHT.

[Seal]

THIS AGREEMENT, dated the 26th day of May, 1909,

BETWEEN CANADIAN WESTINGHOUSE COMPANY, LIMITED, (hereinafter called the Contractor), Party of the First Part, and HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO (hereinafter called the Commission), Party of the Second Part,

WITNESSETH that the parties covenant, promise and agree each with the other as follows:—

The following documents:—

- (a) Commission's "Specifications for Electrical Equipment Niagara Falls and Dundas Stations, Line Switch and Protective Relay System" (70 pages), marked "A."
- (b) Drawings accompanying Commission Specifications (7 drawings), marked "B."
- (c) General conditions of Contract (11 pages), marked "C."
- (d) Contractor's Specifications, covering equipment for Niagara Falls and Dundas Stations, and for the Protective System (57 pages), marked "D."
- (e) Prints of Contractor's Drawings when initialed as approved by Engineer, marked "E."
- (f) Contractor's Bond, marked "F."
- (g) Schedule of prices, marked "G."

shall form part of this contract.

The Contractor agrees:—

1. To furnish, install and test, for stations at or near Niagara Falls and Dundas, the electrical equipment set forth in detail in the said plans, specifications and drawings.

2. To furnish, install and test a protective relay system, including line switches for nine stations, as set forth in detail in said plans, specifications and drawings.

3. To use the best material and construct and install equipment in a thorough workmanlike manner, in strict conformity with said plans, specifications and drawings, to the satisfaction of the Commission's Chief Engineer.

4. To fully complete and deliver to the Commission the said equipment at the following dates:—

- (a) To use every means within the Contractor's power to complete, according to this contract, on or before the 19th December, 1909, for the Niagara station, a bank of three transformers, and a spare transformer with all necessary switches and apparatus for the said Niagara and Dundas stations.
- (b) To complete, according to this contract, the equipment set forth in 4 (a), on or before the 1st March, 1910.
- (c) To complete, according to this contract, on or before the 19th May, 1910, for the Niagara station, a second bank of three transformers, with all necessary switches and apparatus therefor, at the said Niagara and Dundas stations.
- (d) To complete, according to this contract, on or before the 19th July, 1910, the remainder of the said transformers and switches and apparatus.
- (e) To complete, according to this contract, so much of the said relay system as may be required from time to time, for all transformers, switches, and apparatus of the contractor, and of any other contractors with the Commission.
- (f) If any of the equipment set forth in 4 (a) should become defective prior to the 1st March, 1910, the contractor shall immediately replace the said defective equipment.
- (g) The Contractor shall be liable for damages for breach of contract to use every means in the Contractor's power to complete the said equipment in 4 (a) on or before the 19th December, 1909, and for breach of contract to replace the said equipment as provided in 4 (f). Provided that the Contractor shall not be liable for said damages unless and until the arbitrators mentioned in paragraph 9 (a) shall have certified that the Contractor has not used every means reasonably within his power to complete the said equipment before the 19th December, 1909.
- (h) Except as provided in 4 (f) and (g) the Contractor shall not be liable for breach of contract in respect of the said equipment set forth in 4 (a) committed prior to the 1st March, 1910.
- (i) After said 1st March, 19th May, and 19th July, 1910, the Contractor shall be liable in respect of the said equipment to be supplied at said last mentioned dates, as provided in other paragraphs of this contract.

5. To deliver to the Commission a Bond, satisfactory to the Commission, to secure the sum of Sixty Thousand Dollars (\$60,000) for the proper performance of the contract. It shall be provided in said Bond that, without notice to the



Surety, the said documents, and this contract, or any part or parts thereof, may, from time to time, be varied, and that the said Surety shall not be released, or the liability under the Bond affected by any such variations.

6. On or before the 1st January, 1910, upon request in writing to enter into a further contract upon the terms hereof, except as to time of completion, which shall be a reasonable time to be fixed by the said Engineer, to supply any spare and additional equipment that may be required for the said two stations, at the prices set forth in the Schedule of Prices.

7. The Bond to be delivered for said further contract shall be 25 per cent. of the amount thereof.

8. The Commission agrees:—

(a) The Engineer shall, pursuant to paragraph 14 (a) of the General Conditions, give his order to the Contractor to proceed with the works, as soon as possible, and not later than the first day of June, 1909.

(b) To pay to the Contractor, for said equipment, upon the terms and conditions set forth in the said General Conditions and Specifications, the amounts set opposite the name of the said stations, as follows:—  
Niagara Falls, \$137,599. Dundas, \$71,217.

Relay system for Toronto, London, Guelph, Stratford, St. Thomas, Woodstock, Berlin, St. Mary's, Preston, \$54,468.

9. It is further agreed:—

(a) That the Contractor will, within a time specified in writing by the said Engineer, supply the Commission with data and details of all electrical characteristics for the said equipment, and the Commission will, upon request in writing, supply the Contractor with such data and details of electrical power and equipment to be supplied to the Commission by any other Contractor or parties.

(b) If the Contractor does not, in the opinion of the said Engineer, carry on the works with sufficient speed to complete the work at said dates, the Commission may, at its option, be released from this agreement, and the Contractor shall, upon notice in writing, immediately discontinue the works, and if required by the said Engineer, the Contractor shall immediately remove the whole or any part of the said equipment, to be specified by the Engineer, that has been delivered to the Commission, and the Commission may, at its option, proceed with the said works. The Commission shall not be liable for any loss, costs or damage arising before or after the release of the Commission from this agreement.

(c) All the rights and remedies of the Commission and of the Engineer, acting on their behalf, may be exercised and continued concurrently or in the alternative.

(d) If within twelve months from the date of the final certificate of the Engineer, it appears that unsound or defective material has been used by the Contractor, or the said works have not been executed in a substantial, proper, and workmanlike manner, the Contractor shall be liable to the Commission for all damages arising therefrom. No certificate payment, or other act, matter or thing done or omitted under this contract shall bar or prejudice the rights of the Commission in this respect.

- (e) Time shall be of the essence of this agreement.
- (f) For all purposes of this contract, notices shall be served upon the Engineer, or his appointee, in writing for the Commission, and upon the Manager, or his appointee, for the Contractor.
- (g) In case any municipal corporation which shall contract with the Commission for a supply of power, or any person, firm, or corporation which shall contract with any such municipal corporation, or with the Commission, for a supply of power, shall suffer damages by breach of this contract by the Contractor, and such municipal corporation, firm, person or corporation would, if the Contractor had made this contract directly with them, have had a right to recover such damages, or commence any proceedings or any other remedy, the Commission shall be entitled to commence any such proceedings, or bring such action for, or on behalf of, such municipal corporation, person, firm, or corporation, and, notwithstanding any acts, decision or rule of law to the contrary, the Commission shall be entitled to all the rights and remedies of such municipal corporation, person, firm, or corporation, including the right to recover such damages, but no action shall be brought by the Commission until such municipal corporation, person, firm, or corporation shall have agreed with the Commission to pay any costs that may be adjudged to be paid. The rights and remedies of any such municipal corporation, person, firm, or corporation shall not be hereby prejudiced.

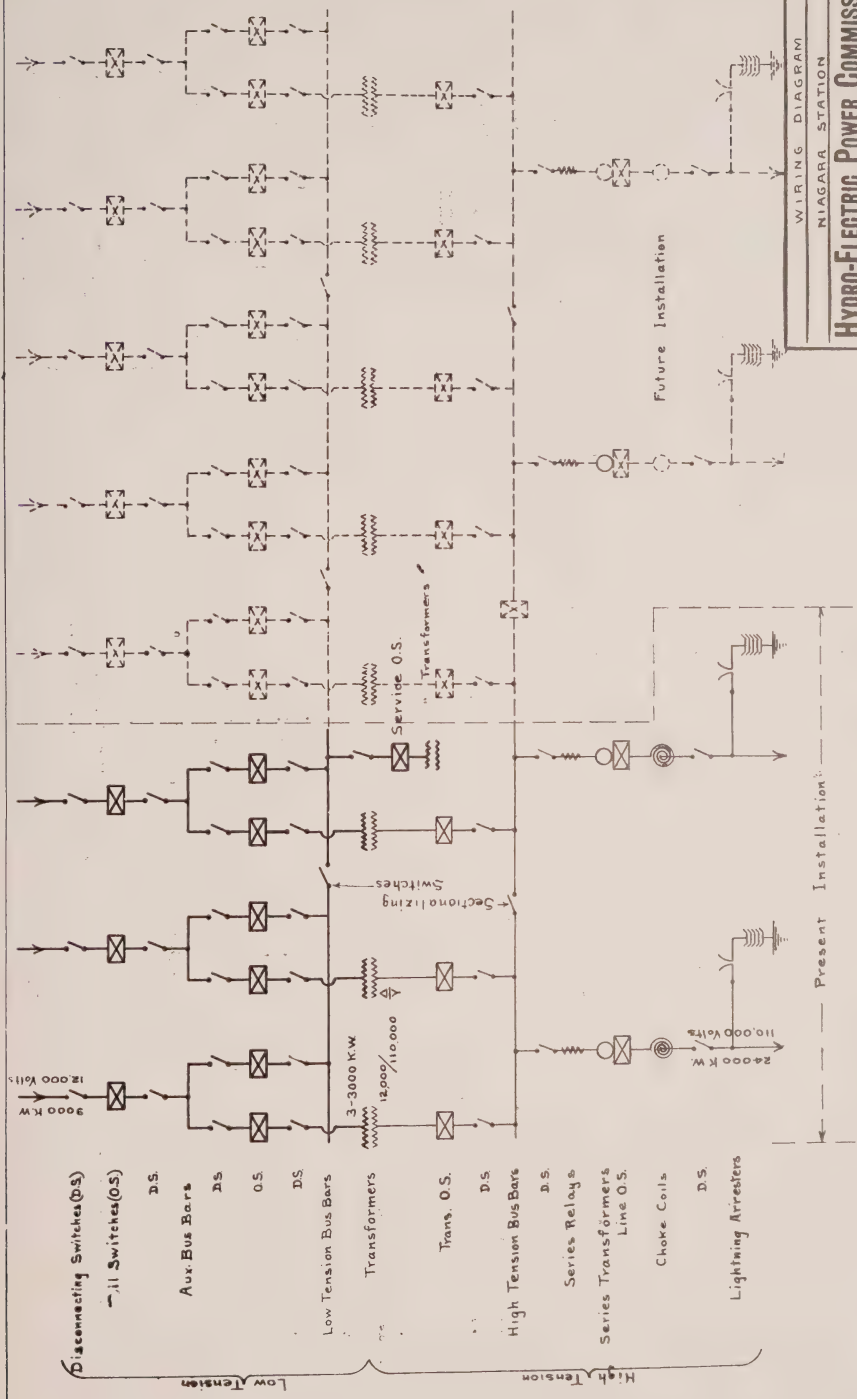
10. Neither party shall be liable for damages for breach of contract caused by strikes, lock-outs, accidents, riots, fires, explosions, acts of God, war, or any other cause, reasonably beyond its control, and should any delay in the performance of this contract be caused to either party thereby, the Contractor shall not be bound to deliver or the Commission shall not be bound to accept equipment during such time, and the time for performance of this contract by both parties shall be correspondingly extended.

Provided further that the parties shall be prompt and diligent to remove the cause or causes of interruption, in so far as they are able, and when such interruption shall have ceased, the parties shall be prompt and diligent to perform the contract.

Provided that in construing this paragraph the doctrine of *ejusdem generis* shall not be applied.

11. (a) If any difference shall arise during the progress or after the completion of the works, as to any matter or thing arising under or out of this contract, such difference shall be referred to two arbitrators, one to be chosen by each of the parties hereto, and they shall choose a third arbitrator, but if they cannot agree, such third arbitrator shall be chosen by the Chief Justice at the time of the King's Bench Division of the High Court of Justice. When possible the arbitrators shall decide such difference in a summary manner. Either party may appeal from any award of the arbitrators, as provided by the Arbitration Act, R.S.O., Chap. 62, but no such appeal shall be carried beyond the decision of the Court of Appeal of Ontario.

- (b) The arbitrators shall not consider any matter or difference which is expressly or by implication required or permitted to be decided by the



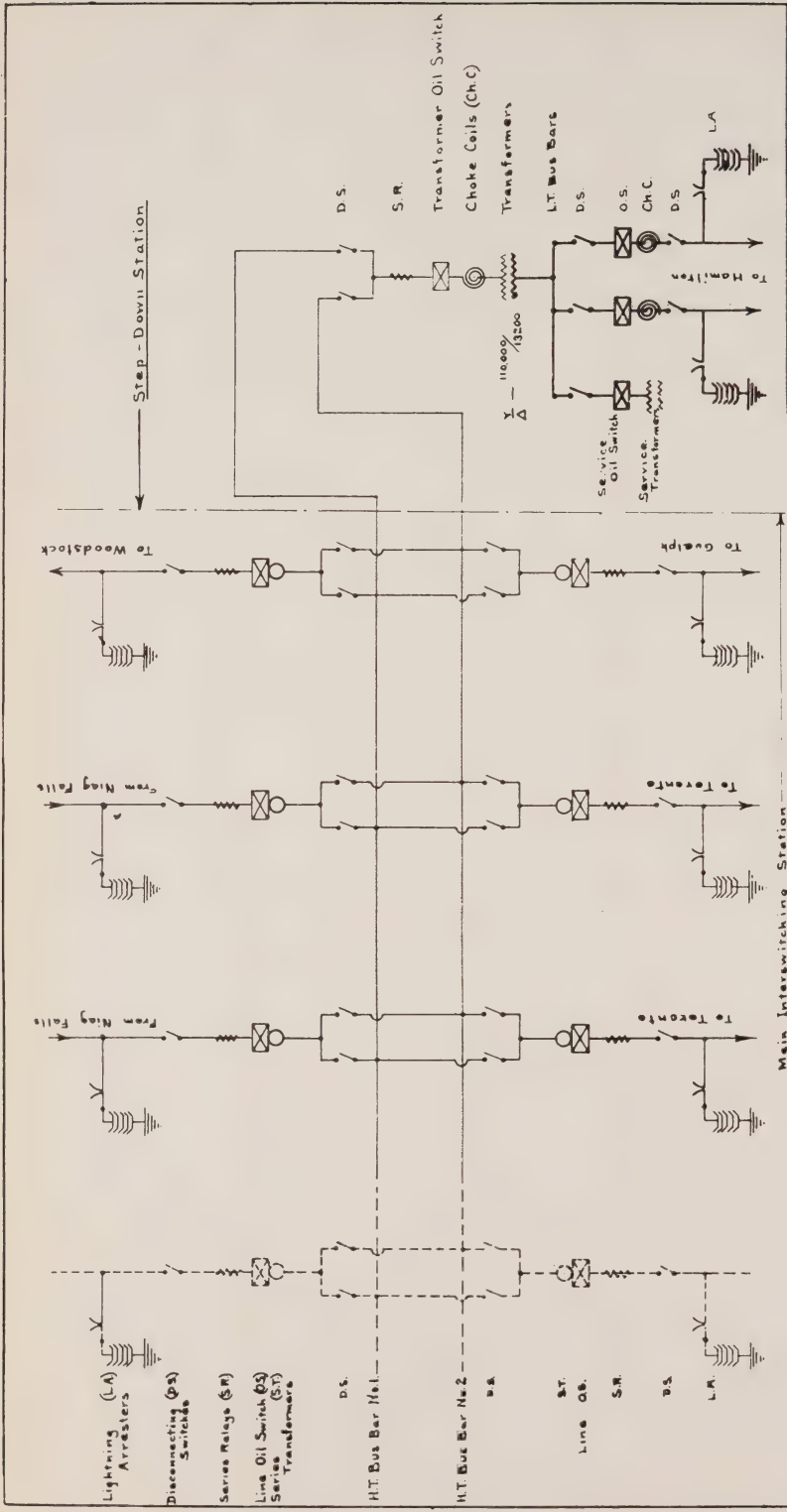
WIRING DIAGRAM  
 NIAGARA STATION  
**HYDRO-ELECTRIC POWER COMMISSION**  
 OF ONTARIO  
 Scale: Drawn by J. F. E. D. 1909  
 Checked by: July 1909  
 NO. 2553

P.W. SOTHMAN  
 Chief Engineer

**HYDRO-ELECTRIC POWER COMMISSION**  
**OF ONTARIO**

Scale  
 Drawn by  
 Checked by  
 Date

Toronto, Mar. 1st 1909  
 244 NO. 2-S-54



Note: Present Installation \_\_\_\_\_  
 Future " \_\_\_\_\_

P.W. SOTHMAN  
 Chief Engineer.

**HYDRO-ELECTRIC POWER COMMISSION**  
**OF ONTARIO**

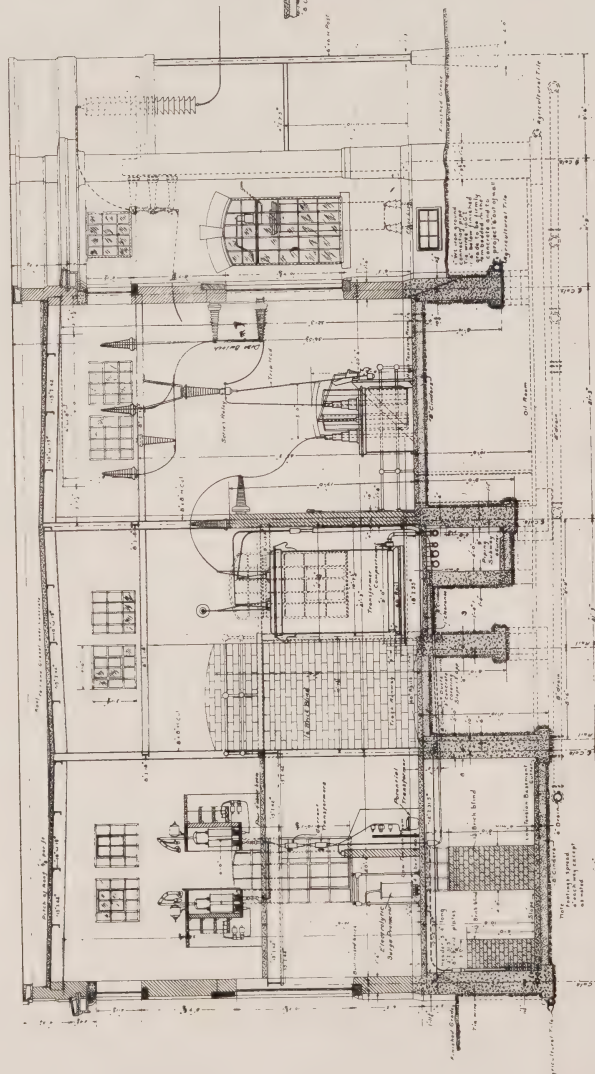
Scale  
 Drawn by  
 Checked by  
 Date

Toronto, Mar. 1st 1909  
 244 NO. 2-S-54





187 0



P.W. SOTHMAN  
Chief Engineer.

Note: Do not use this drawing for piping  
& electrical installation

Note: A door & window frame and opening in concrete walls over 4" thick,  
shall be built in by larger than width of the opening

Toronto Section of	
Riverside Electric Power Commission	
Drawn by	Scale
Checked by	Project No.
Approved by	Drawn by
No. 415-3087	

Revised Section 2

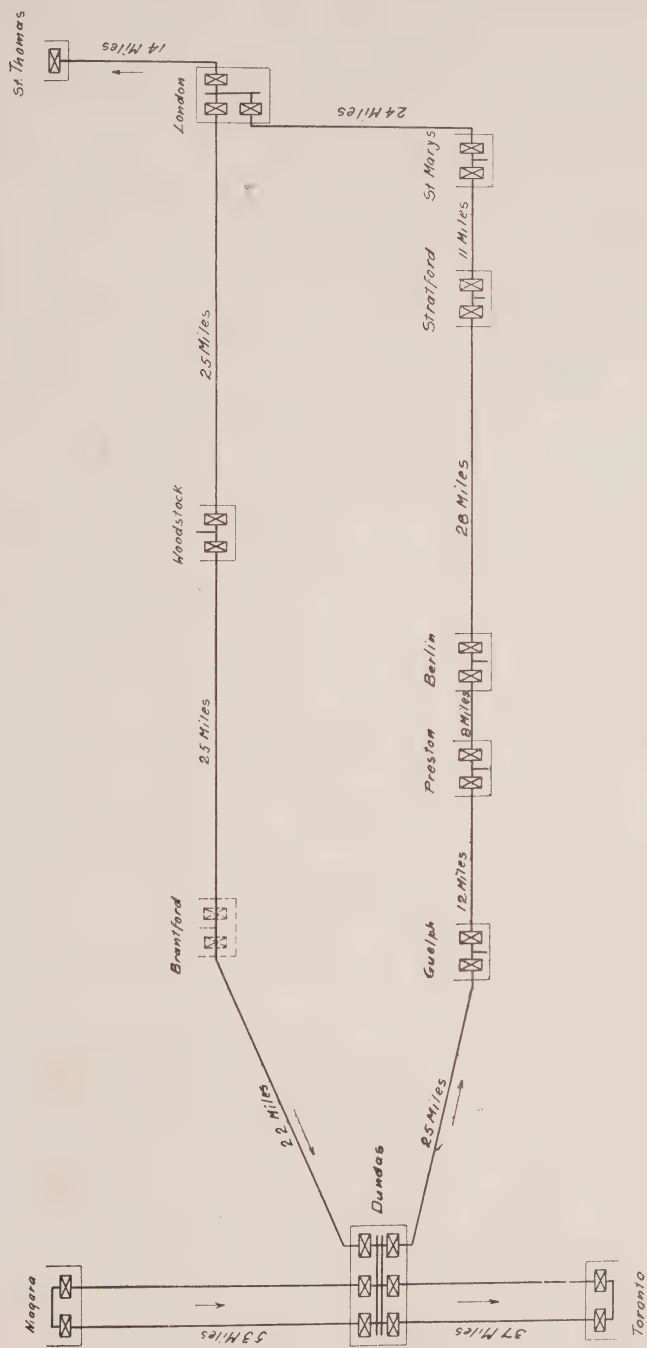


Diagram Showing Line Switches  
of Differential Relay System  
**HYDRO-ELECTRIC POWER COMMISSION**  
OF ONTARIO  
Toronto, March 3<sup>rd</sup> 1909  
Scale  
Drawn by  
S. J. B. 444  
NO. 2542

P. W. SOTHMAN  
Chief Engineer.

Present Installation ———  
Future Installation - - - -

Note: Distances between Stations are approximate





Engineer, or as to the grounds upon which, or mode in which, any opinion may have been formed, or discretion exercised, by the Engineer. If any such matter or difference shall arise, and the Contractor claims that such matter or difference should be determined by arbitrators, the Contractor may apply in writing to the Commission, to waive this paragraph 11 (b): thereupon the Commission shall appoint a time and place to hear any representations of the Engineer or Contractor, and the Commission may, in its sole discretion, waive the provisions of this paragraph 11 (b), and permit the said matter or difference to be referred under paragraph 11 (a) to said arbitrators.

12. This agreement shall extend to, be binding upon, and enure to the benefit of the executors, administrators, and assigns of the said parties.

IN WITNESS WHEREOF the Commission and the Contractor have respectively affixed their corporate seals and the hands of their proper officers.

Hydro-Electric Power Commission of Ontario.

A. BECK.

[Seal]

JOHN S. HENDRIE.

Canadian Westinghouse Company, Limited.

PAUL J. MYLER, *Vice-President.*

[Seal]

JNO. H. KERR, *Secretary.*

#### MECHANICAL EQUIPMENT.

The travelling cranes, oil tanks and heating boilers are the only auxiliary features which have as yet been provided for. These were considered the most important because they either had a bearing on the design of the buildings or required installation simultaneous with the buildings.

The heating and lighting systems, water pumps, oil pumps, and compressors and the necessary wiring and piping systems, are all receiving consideration and specifications are being prepared.

Specifications for travelling cranes were issued in August and tenders were received from manufacturers of cranes in Canada, England and the United States. A full consideration of the different tenders resulted as follows:—Royce Limited, Manchester, England, will supply a 45-ton electric hoist crane for each Niagara Falls and Dundas, and Mussels Limited, of Toronto, will supply a 25-ton hand power crane for each Toronto, London, Guelph, Preston, Berlin, Stratford, St. Mary's, Woodstock and St. Thomas. The tabulated tenders follow:—

#### FORM OF TENDER ATTACHED TO SPECIFICATIONS FOR CRANES FOR TRANSFORMER STATIONS—C. 90,719.

....., the undersigned, hereby offer the Hydro-Electric Power Commission of Ontario to furnish all the necessary material, labor, tools, machinery and other plant, and to execute and complete in a satisfactory and

workmanlike manner all work required in connection with the manufacture and shipment of cranes, all according to the specifications and drawings exhibited to ..... complete for the sum of ..... Dollars (\$) ), the price for the cranes for the different stations being as follows:—

Niagara Falls .....	\$
Dundas .....	\$
Toronto .....	\$
London .....	\$
Guelph .....	\$
Preston .....	\$
Berlin .....	\$
Stratford .....	\$
St. Mary's .....	\$
Paris .....	\$
Woodstock .....	\$
St. Thomas .....	\$

..... further guarantee if the contract for these cranes is awarded to ..... to ship the crane for Niagara Falls within six weeks and for Dundas within seven weeks, on the receipt of order, and one crane every seven days thereafter until all cranes are shipped.

..... further offer to deduct from the lump sum, the amount stated for the crane for Paris station if the Commission decides not to order one for that station.

..... herewith submit detail specifications, sketches showing the clearance, wheel loads and bases, general outline, etc., of each crane ..... propose furnishing.

..... further hold ..... ready to enter into a contract in form satisfactory to the Commission for the due and proper execution of the work at the rates and on the terms herein stated.

..... hereby certify that ..... have carefully investigated all conditions and items of cost which may or can enter into the cost of the work to .....

Signed .....

P. O. Address .....

.....  
.....

Dated .....

.....

## HYDRO-ELECTRIC POWER COMMISSION.

## TENDERS FOR TRANSFORMER STATION CRANES—OPENED SEPTEMBER 9TH, 1909.

Tenderer.	Niagara Falls.	Dundas.	Toronto.	London.	Guelph.	Preston.	Berlin.	Stratford.	St. Mary's.	Paris.	Woodstock.	St. Thomas.	Total.	Deliveries.	Weeks.
1. Canada Foundry Company.....	\$ 3,875	\$ 1,833	\$ 1,688	\$ 1,698	\$ 1,683	\$ 1,686	\$ 1,689	\$ 1,695	\$ 1,698	\$ 1,689	\$ 1,695	\$ 1,698	\$ 22,627	N. F. 6 weeks D. 7 weeks 1 per week do do	N. F. 6 weeks D. 7 weeks 1 per week do do
2. Manning, M. & M.....	3,335	1,400	1,325	1,325	1,325	1,325	1,325	1,325	1,325	1,325	1,325	1,325	17,985		
3. Stother & Pitt.....	3,600	1,750	1,585	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	1,604	21,371	N. F. 10 weeks D. 9 weeks 1 per week	N. F. 10 weeks D. 9 weeks 1 per week
4. Royce, Limited.....	3,150	2,362	2,021	2,045	2,021	2,021	2,021	2,045	2,045	2,045	2,045	2,045	25,833	N. F. 7 weeks D. 8 weeks 1 per week	N. F. 7 weeks D. 8 weeks 1 per week
5. Whiting.....	2,070	850	790	790	790	790	790	790	790	790	790	790	10,810	N. F. 6 weeks D. 7 weeks 1 per week	N. F. 6 weeks D. 7 weeks 1 per week
6. Sellers.....	5,645	2,075	1,895	1,864	1,864	1,864	1,864	1,864	1,864	1,863	1,864	1,864	26,390	N. F. 11 weeks D. 12 weeks 1 per week	N. F. 11 weeks D. 12 weeks 1 per week
7. Dominion Bridge...	3,400	1,800	1,675	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	1,700	22,175	N. F. 12 weeks D. 8 weeks 1 per week	N. F. 12 weeks D. 8 weeks 1 per week
8. Brown-Hoist.....	6,885	3,265	3,085	3,080	3,090	3,090	3,090	3,090	3,090	3,085	3,085	3,085	41,020	N. F. 7 weeks D. 7 weeks 1 per week	N. F. 7 weeks D. 7 weeks 1 per week
9. Mussels (Northern).....	3,675	1,295	1,115	1,145	1,145	1,145	1,145	1,145	1,145	1,145	1,145	1,145	16,900	N. F. 7 weeks D. 7 weeks 1 per week	N. F. 7 weeks D. 7 weeks 1 per week
10. Babcock & Wilcox.....	4,753	2,127	2,127	2,137	2,137	2,137	2,137	2,137	2,137	2,137	2,137	2,137	28,240	N. F. 8-D. 12 weeks 1 per week	N. F. 8-D. 12 weeks 1 per week
11. Wilcox, E. M....	5,900	2,643	2,643	2,643	2,643	2,643	2,643	2,643	2,643	2,643	2,643	2,643	35,000	N. F. 6-D. 7 weeks 1 per week	N. F. 6-D. 7 weeks 1 per week
12. Canadian Fairbanks.....	3,295	1,190	1,075	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	1,155	15,955	N. F. 6 weeks D. 7 weeks 1 per week	N. F. 6 weeks D. 7 weeks 1 per week

After due consideration of all the tenders submitted, contracts were awarded

Niagara Falls—Royce, Limited, England .....	\$3,150
Dundas—Royce, Limited, England .....	3,150
Toronto—Mussens, Limited, Toronto .....	1,115
London—“ “ “ .....	1,145
Guelph—“ “ “ .....	1,145
Preston—“ “ “ .....	1,145
Berlin—“ “ “ .....	1,145
Stratford—“ “ “ .....	1,145
St. Mary’s—“ “ “ .....	1,145
Woodstock—“ “ “ .....	1,145
St. Thomas “ “ “ .....	1,145
Total.....	\$16,575

After specifications were issued it was found that it would be necessary to supply a crane for Dundas similar to that at Niagara. This was purchased from Royce, Limited, at the same price as the Niagara crane.

SPECIFICATIONS FOR HEATING BOILERS.

The specifications for station heating boilers were written and sent out to the various manufacturers during the latter part of September. Tenders based upon the supply of return Tubular Boilers were received on October 4th, but later new tenders were asked for covering cast iron Sectional Boilers as an alternative. The new tenders have been received, but no contracts have yet been placed.

No boiler will be required for the Woodstock station, as steam for heating will be obtained from the boilers already installed in the present pumping station.

A tabulated list of the tenders received is given on page —

FORM OF TENDER ATTACHED TO SPECIFICATIONS FOR BOILERS FOR HEATING OF STATIONS.

....., the undersigned, hereby offer the Hydro-Electric Power Commission of Ontario, to furnish all the necessary materials, tools, machinery and other plant and to execute and complete in a satisfactory and workmanlike manner all work required in connection with the manufacture, shipment, and erection complete of boilers, all according to the specifications exhibited to ..... for the sum of ..... Dollars (\$) for coal fired boilers, or for the sum of ..... Dollars (\$) for gas fired boilers; the price for the boilers for the different stations being as follows:—



	For Coal Fired Boilers.	For Gas Fired Boilers.
Niagara Falls.....	(\$ )	(\$ )
Dundas.....	(\$ )	(\$ )
Toronto.....	(\$ )	(\$ )
London.....	(\$ )	(\$ )
Guelph.....	(\$ )	(\$ )
Preston.....	(\$ )	(\$ )
Berlin.....	(\$ )	(\$ )
Stratford.....	(\$ )	(\$ )
St. Mary's.....	(\$ )	(\$ )
Paris.....	(\$ )	(\$ )
St. Thomas.....	(\$ )	(\$ )

Type of boilers shall be ..... according to the enclosed photographs and drawings.

..... further agree to furnish boilers as required and ship same f.o.b. railway sidings, but not including haulage to station site or erection, for the following prices:—

	For Coal Fired Boilers.	For Gas Fired Boilers.
Niagara Falls.....	(\$ )	(\$ )
Dundas.....	(\$ )	(\$ )
Toronto.....	(\$ )	(\$ )
London.....	(\$ )	(\$ )
Guelph.....	(\$ )	(\$ )
Preston.....	(\$ )	(\$ )
Berlin.....	(\$ )	(\$ )
Stratford.....	(\$ )	(\$ )
St. Mary's.....	(\$ )	(\$ )
Paris.....	(\$ )	(\$ )
St. Thomas.....	(\$ )	(\$ )

..... guarantee if the contract for these boilers is awarded to ..... to ship the boilers for Niagara Falls, Dundas and Toronto, within six weeks, and for London within seven weeks from the date of receipt of order, and one boiler every week thereafter until all are shipped.

..... further offer to deduct from the lump sum, the amount stated for the boiler for Paris station, if the Commission decides not to order one for that station.

..... herewith submit detail specifications, sketches showing arrangement, general dimensions, etc., of each boiler .....propose furnishing.

..... further hold ..... ready to enter into a contract in form satisfactory to the Commission for the due and proper execution of the work at the rates and on the terms herein stated and ..... further agree to furnish security for the due performance of the contract in a bond for 25 per cent. of the amount of the entire contract, with satisfactory sureties.

..... herewith enclose an accepted bank cheque payable to the order of the Chairman of the Hydro-Electric Power Commission of Ontario, for the sum of ..... dollars (\$ ), being 5 per cent. of the amount of the entire contract.

..... hereby certify that ..... have carefully investigated all conditions and items of cost which may or can possibly enter into the cost of the work to .....

Signed .....

P. O. Address .....

.....

.....

Dated .....

## HYDRO-ELECTRIC POWER COMMISSION. TENDERS FOR HEATING BOILERS.

Contractor.	Niagara Falls.	Dundas.	Toronto.	London.	Guelph.	Preston.	Berlin.	Stratford.	St. Mary's	Paris.	St. Thomas.	Type.	Totals.	Remarks.
	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$		\$	
Pease Foundry Co. ....	424	424	424	377	310	310	310	310	310	310	310	Cast iron.	3,819	Erected. Coal fired.
Gurney " " .....	305	305	300	265	198	200	203	205	210	210	210		2,611	" " "
King Radiator " " .....	304	304	304	277	241	241	241	241	241	241	241		2,870	" " "
Dominion Radiator Co. ....	.....	.....	.....	.....	.....	.....	.....	.....	.....	230	.....		2,864	Erected to burn hard coal or gas.
" " " " .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	256.75	.....		3,242	Erected to burn soft coal.
Taylor-Forbes Co. ....	327.67	342.95	333.50	300.75	243.25	247.61	239.61	250.04	255.52	255.04	251.43		3,047.37	Erected.
E. Leonard .....	259	257	280	230	207	207	206	205	205	206	204	Vertical tube.	2,446	Gas or coal fired.
Goldie & McCulloch .....	297	295	296	251	216	215	216	218	219	217	220		2,660	Coal fired.
" " " " .....	322	320	321	276	241	240	241	243	244	242	245		2,935	Gas fired.
Canada Foundry Co. ....	449	446	436	390	325	325	326	328	328	326	329		4,008	Coal fired.
John Inglis Co. ....	395	390	360	365	285	288	295	300	300	295	305		3,578	" " "
Jenckes Machine Co. ....	348	351	354	329	247	246	248	248	249	246	249		3,115	" " "
" " " " .....	373	376	379	354	272	271	273	273	274	271	274		3,390	Gas fired.
R. Whitelaw .....	290	290	290	245	242	245	245	245	245	245	245		2,830	Coal fired.
" " " " .....	447	445	448	415	317	318	317	318	317	318	317	Return tubular horizontal.	3,977.50	" " "
" " " " .....	475	470	475	435	340	340	340	340	340	340	340		4,235	Gas fired.
E. Leonard .....	434	432	435	400	360	360	360	360	349	350	348		4,188	Coal or gas fired.
Geo. White .....	693	689	695	545	499	499	497	495	495	494	492		6,096	" " "
Goldie & McCulloch .....	365	361	363	294	277	276	277	279	280	298	282		3,332	Coal fired } F.O.B. Cars.
" " " " .....	390	386	388	319	302	301	302	304	305	303	307		3,607	Gas fired.
Canada Foundry Co. ....	621	711	669	652	555	558	558	560	561	558	562		6,565	Coal fired.
" " " " .....	705	795	752	731	632	635	635	637	638	635	639		7,434	Gas fired.
John Inglis Co. ....	630	610	555	615	.....	.....	.....	.....	.....	.....	.....		.....	Coal fired.
Jenckes Machine Co. ....	680	684	688	577	565	564	566	566	567	564	567		6,587	" " "
" " " " .....	695	699	703	593	585	584	586	586	587	584	587		6,789	Gas fired.

SPECIFICATIONS FOR OIL TANKS.

Specifications and drawings were issued in July for steel tanks required for the storage of transformer oil in each of the Commission's stations. These tanks are to be of the plain cylindrical type, and two will be located in each of the station basements, one to receive untreated oil and the other to receive and store clean or treated oil.

Tenders were received from several manufacturers on August 20th for this work and contracts were immediately let as follows:—

To E. Leonard & Sons, of London, Ont., tanks for the stations at London, Stratford, St. Mary's, Woodstock and St. Thomas, with a 10 months' option for the supply of tanks for the Paris station.

To Goldie & McCulloch, Ltd., of Galt, tanks for the stations at Niagara Falls, Dundas, Guelph, Preston and Berlin.

To Polson Iron Works, Ltd., of Toronto, tanks for the Toronto station.

Tenders and contracts for the tanks are appended below.

HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO. FORM OF TENDER ATTACHED TO SPECIFICATIONS FOR OIL STORAGE TANKS FOR TRANSFORMER STATIONS  
—T. 90,718.

....., the undersigned, hereby offer the Hydro-Electric Power Commission of Ontario, to furnish all the necessary materials, labor, tools, machinery and other plant, and to execute and complete in a satisfactory and workmanlike manner all work required in connection with the manufacture, testing and shipment of oil tanks, all according to the specifications and drawings exhibited to ..... complete for the sum of ..... dollars (\$ .....), the price for the tanks for the different stations being as follows:—

Niagara Falls.....	\$.....	Berlin.....	\$.....
Dundas.....	\$.....	Stratford.....	\$.....
Toronto.....	\$.....	St. Mary's.....	\$.....
London.....	\$.....	Paris.....	\$.....
Guelph.....	\$.....	Woodstock.....	\$.....
Preston.....	\$.....	St. Thomas.....	\$.....

..... further guarantee if the contract for these tanks is awarded to ..... to ship the tanks for Niagara Falls within ..... weeks and for Dundas within ..... weeks of the receipt of the order, and two tanks every ..... days thereafter, until all tanks are shipped.

..... further offer to deduct from the lump sum the amount stated for the tanks for Paris station if the Commission decides not to order these for that station.

..... herewith submits sketches showing the sizes of plates, reinforcements, etc., of each tank ..... propose furnishing.

..... further hold ..... ready to enter into a contract in form satisfactory to the Commission for the due and proper execution of the work at the rates and on the terms herein stated.

..... hereby certify that ..... have carefully investigated all conditions and items of cost which may or can enter into the cost of the work to .....

Signed .....  
.....  
.....

Dated .....



## HYDRO-ELECTRIC POWER COMMISSION—TENDERS FOR OIL STORAGE TANKS.

	Niagara.	Dundas.	Toronto.	London.	Guelph.	Preston.	Berlin.	Stratford.	St. Mary's.	Paris.	Woodstock.	St. Thomas.	Shipments.			Bulk.	Plates.
	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	\$ c.	Niagara.	Dundas.	Delivery.	\$	In.
E. Leonard & Sons, No. 110 safe .....	612 00	606 00	440 00	417 00	436 00	432 00	432 00	428 00	426 00	430 00	426 00	424 00	6 weeks	8 weeks	2 each week	5,599 00	7/16 and 3/8
No. 151 safe .....	762 00	756 00	564 00	541 00	560 00	556 00	556 00	552 00	550 00	554 00	550 00	548 00	6 weeks	8 weeks	2 each week	7,049 00	19/32 & 17/32
R. Whitelaw, Wood- stock .....	.....	.....	.....	.....	.....	790 00	790 00	790 00	790 00	790 00	775 00	790 00	.....	.....	2 every 10 days	4,515 00	3/8
Goldie & McCulloch, No. 100 working...	588 00	578 00	460 00	460 00	430 00	430 00	430 00	456 00	458 00	452 00	456 00	462 00	6 weeks	6 weeks	2 every 10 days	5,660 00	
*Watrous Engine Works.....	924 00	924 00	736 00	736 00	736 00	736 00	736 00	736 00	736 00	736 00	736 00	736 00	.....	.....	.....	.....	1/2
Toronto Iron Works.	955 68	955 68	792 20	842 20	826 00	828 70	834 58	836 80	839 50	831 40	834 58	842 20	5 weeks	6 weeks	2 every 6 days	10,026 52	9/16 and 5/8
Jenckes Machine Co.,	586 00	594 00	494 00	506 00	498 00	494 00	502 00	502 00	506 00	494 00	498 00	506 00	4 weeks	5 weeks	2 every week	6,180 00	3/8
(Revised Tender, rec'd Aug. 28, '09)..	574 00	578 00	472 00	478 00	474 00	472 00	476 00	476 00	478 00	472 00	474 00	478 00	4 weeks	5 weeks	2 every week	5,902 00	3/8
John Inglis Co.....	950 00	945 00	710 00	700 00	705 00	705 00	710 00	710 00	710 00	705 00	710 00	710 00	4 weeks	5 weeks	2 every 4 days	8,970 00	7/16 and 1/2
" " .....	710 00	705 00	580 00	580 00	570 00	570 00	580 00	580 00	580 00	570 00	580 00	580 00	4 weeks	5 weeks	2 every 4 days	7,185 00	3/8
Canada Foundry Co..	684 00	677 00	525 00	551 00	541 00	543 00	545 00	549 00	551 00	545 00	549 00	551 00	8 weeks	8 weeks	2 every 15 days	6,811 00	7/16
Polson Iron Works..	858 00	852 00	435 00	480 00	470 00	472 00	474 00	478 00	480 00	474 00	478 00	480 00	7 weeks	7 weeks	2 every 4 days	6,431 00	7/16 and 3/8

\* F.O.B. Brantford.

After due consideration of the merits of the different tenders, contracts for tanks were finally awarded the following firms:—

To E. Leonard & Sons:		
For London—2 tanks .....	\$417	
Stratford—2 tanks.....	428	
St. Mary's—2 tanks.....	426	
Woodstock—2 tanks.....	426	
St. Thomas—2 tanks.....	424	
Total .....		\$2,121
Paris is optional at .....	\$430	
Total with Paris .....	\$2,551	
To Goldie & McCulloch:		
For Niagara Falls—2 tanks .....	\$588	
Dundas—2 tanks.....	578	
Guelph—2 tanks.....	430	
Preston—2 tanks .....	430	
Berlin—2 tanks.....	430	
Total .....		2,456
To Polson Iron Works:		
For Toronto—2 tanks.....	\$435	
		435
Grand total .....		\$5,012 without Paris.

### III. MUNICIPAL WORK.

#### MUNICIPAL DEPARTMENT.

The Municipal Department was organized to look after the interests of the municipalities, to help those municipalities that have contracted for power, to make up estimates for those that wish information on the cost of power, cost of municipal distribution, etc., and to give engineering aid and advice to municipalities who propose to make contracts with power companies.

Taking these three divisions in reverse order, the work done is as follows:—

*Madoc*: They planned to contract for power with a power transmission company and we wrote several letters answering their questions regarding various points in the proposed contract.

*Weston*: A representative from Weston secured information from the Engineering Department on the possible methods of furnishing that town with power.

*Aylmer-Ayr-Doon*: Representatives have called and explained the method of securing power from the transmission line, have left model by-laws, and volunteered any information needed. The following is a blank by-law submitted:—

#### MODEL.

#### BY-LAW TO SUBMIT A QUESTION.

*City of*.....

*By-Law No.*.....

To take the vote of the ratepayers of the City of..... entitled to vote on money by-laws on a question to be submitted whether the said ratepayers are in favor of a supply of electric power from the Hydro-Electric Power Commission of Ontario.

Whereas the Municipal Council of the Corporation of.....deems it advisable to submit to the ratepayers of the said City of.....entitled to vote on money by-laws a question as to whether the said ratepayers are in favor of a supply of electric power from the Hydro-Electric Power Commission of Ontario;

Therefore the Council of the Corporation of the City of .....enacts as follows:—

1. That the following question be submitted to the ratepayers of the Municipal Corporation of the City of.....entitled to vote on money by-laws:

Are you in favor of obtaining from the Hydro-Electric Power Commission of Ontario a supply of electric power?

2. That the votes of said ratepayers shall be taken on this question at the following times and places and by the Deputy Returning Officers and Poll Clerks hereinafter mentioned, that is to say (set out here, day and hour for taking vote, polling divisions, wards, names of Deputy Returning Officers, Poll Clerks, places of voting). The date fixed for vote not to be less than three nor more than five weeks after first publication of this by-law. (See Sec. 338 of Municipal Act.)

3. A true copy of this by-law shall be published in the following newspapers on the days hereinafter mentioned, that is to say (follow ss. 2, Sec. 338, Municipal Act), and a copy of this by-law shall be posted at (name four most public places for posting).

4. On the .....day of.....at his office in the Council Chamber, on.....in the City of.....at.....o'clock noon, the Mayor will in writing signed by him appoint two persons to attend at the final summing up of the votes by the Clerk of this Corporation and one person to attend each polling place on behalf of the persons interested in and desirous of the answering of the said question in the affirmative and a like number on behalf of the persons interested in and desirous of the answering of the said question in the negative, respectively.

5. The.....day of.....at the said Council Chamber .....at.....o'clock, is hereby appointed for the summing up by the Clerk of this Corporation of the number of votes given in the affirmative and in the negative, respectively.

Made, passed and enacted this ..... day of .....

.....Mayor.

.....Clerk.

#### NOTICE.

Take notice the above is a true copy of a by-law passed by the Municipal Council of the City of.....on the.....day of.....

And further take notice that at the hour, day and places therein fixed for taking votes of the electors the polls will be held.

First publication.....day of.....

.....City Clerk.

Council Chamber,.....day of.....



## ESTIMATES, ETC.

Under the second heading, that is making up estimates for those who wish information on the cost of power, cost of municipal distribution, etc., the following work has been done:

*Brampton, Milton, Acton and Georgetown:* At the request of these municipalities estimates were made of the cost of 24-hour power delivered to their town limits at 13,200 volts in the following quantities:

Georgetown	for 800 h.p.	\$27.17	per horse power per annum.
Brampton	" 800 h.p.	28.93	" " "
Milton	" 500 h.p.	38.56	" " "
Acton	" 600 h.p.	30.46	" " "
2,500 h.p.			

These prices are based on a double circuit 110,000 volt line from Trafalgar (on the main Dundas to Toronto line) to Georgetown, with an interswitching station at Trafalgar and a step-down station at Georgetown, from which point the power is distributed to the above municipalities at 13,200 volts.

The above amounts include all costs of transmission, transformation and distribution and power at Niagara Falls at \$9.40, which will be reduced to \$9.00 as soon as the quantity taken by the Commission exceeds 25,000 horse power.

These prices were submitted to the municipalities on April 19th, 1909.

A canvass was made of the towns showing the following demand for power in this district:

	Total Demand.	Maximum safe amount to be contracted for.
Acton.....	135	75
Brampton..	...	400
Georgetown .....	277	250
Milton .....	715	500
		1,225

*Ridgetown:* The power conditions were investigated, but no estimates were requested. The data are at hand when needed.

*Windsor:* A power canvass was made of Windsor City in the early part of the year, showing a demand for about 1,100 horse power. Estimates were made of the capital costs of apparatus, etc., for transformation, distribution of power, also for street and house lighting, which are reproduced herewith.

TORONTO, March 31st, 1909.

## ESTIMATE FOR WINDSOR.

<i>Capital cost</i> of 2,000 horse power switching apparatus in city station, equals .....	\$9,123.00
<i>Capital cost</i> of power distribution system in the city to serve 1,056 horse power in connected motor-load. (Feeders and lines of 2,000 horse power capacity.) (426 horse power of this for water works pumps, during fires.) Equals.....	24,582.00
<i>Capital cost</i> of street lighting system consisting of 110 arcs and 450 80-candle-power Tungstens with necessary station equipment, equals.....	42,849.00



*Capital cost* of incandescent lighting system to serve 10,000 16-candle-power equivalent, with necessary station equipment, equals..... 42,500.00

*Walkerville*: A power canvass was made of the town, showing a total demand for about 1,300 horse power.

*Sandwich*: A power canvass was made of this village, showing a total demand for about 60 horse power.

*Elmira*: Estimates were made and sent to Elmira, giving the capital cost and annual charges on both single and double circuit transmission lines from Waterloo at 13,200 volts, cost of station equipment for both single and double circuit incoming lines and the cost of distribution of power and street lighting. These estimates are given below. A power canvass was also made of the town and data on cost of electrical apparatus secured and sent there.

## ESTIMATE No. 1.

*Prices of 13,200 Volt Power to Elmira.*

	Capital Cost.	%	Annual Charges.
Estimated for 225 H.P.			
11 miles double circuit No. 6 wire pole line, at \$1,700.00.....	\$ 18,700	6	\$ 1,122
Measuring instruments in Elmira .....	1,442	6	87
Disconnecting Station on poles at Waterloo.....	415	6	25
	20,557	.....	1,234
Engineering and Contingencies, 10 per cent.....	2,056	.....	123
	22,613	.....	1,357
Interest during construction, 3 per cent .....	676	.....	.....
	23,291	.....	.....
Interest at 4 per cent., Sinking Fund at 1.8 per cent. on \$23,291.00..	.....	.....	1,351
Line loss H.P. at \$9.40.....	.....	.....	38
Operating at \$40 per mile.....	.....	.....	440
Total Annual Cost to transmit 225 H.P.....	.....	.....	3,186

Cost per H.P., \$14.16. Total cost of power to Elmira: \$24.50 + \$14.16 = \$38.66. Total cost per H.P. to build, \$103.52.

July 8th, 1909.

ESTIMATE NO. 2.

Cost of Distribution in Elmira.

	Capital Cost.	%	Annual Charges.
Material needed in Station is :			
	\$		\$
2 Incoming line panels, 13,200 V., at \$600.....	1,200	6	72
4 Sets disconnecting Switches, 13,200 V.....	360	6	22
3 100 K.W. 13,200/2,200 V. step-down transformers.....	4,200	6	252
3 2,200 V. outgoing feeder panels, at \$400.....	1,200	6	72
3 Sets 2,200 V. Lightning Arresters, at \$50.....	150	6	9
1 Potential Transformer on 2,200 V. Busses.....	50	6	3
1 Indicating Voltmeter on 2,200 V. Busses.....	51	6	3
2 Sets of 13,200 V. Lightning Arresters.....	600	6	36
2 Sets of 13,200 V. Choke Coils .....	420	6	25
Copper wiring in Station.....	100	6	6
	8,331	6	500
Station of brick, about 30 feet by 20 feet by 15 feet high .....	1,500	2	30
Material needed for Power Distribution :			
144 Poles, at \$10, erected with cross arms and braces.....	1,440	8	115
470 Insulators at 25c., erected with pin .....	118	5	6
7,065 lbs. copper at 20c., erected, weatherproof,.....	1,413	2	28
Incandescent Distribution on basis of 900-16 c.p., connected up at \$5.50 per 16 c.p. ....	4,950	6	297
Street Lighting on a basis of 80-32 c.p. 110 V. Tungsten lamps, con- nected in groups on service transformers, and switched on in groups at dusk, at \$12.50 per lamp.....	1,000	24	240
Interest at 4½ per cent., Sinking Fund at 1.8 per cent.....			1,181
Administration and Labor.....			850
Power cost per annum, 225 H.P., at \$38.66 .....			8,699
Total Capital cost.....	18,752	.....	11,946
Estimated Income :			
Street Lighting (charged off) at rate of 5c. per night per 32 c.p., all night, 80-38 c.p. ....			1,460
Power sold (including water works) at \$40.00 for 225 H.P .....			9,000
Incandescent Income, 150 services, at \$18.00.. ..			2,700
			13,160

## ESTIMATE NO. 3.

*Prices of 13,200 Volt Power to Elmira.*

	Capital Cost.	%	Annual Charges.
Estimated for 225 H.P. over a single circuit:	\$		\$
11 Miles single circuit, No. 6 wire pole line, at \$1,110 .....	12,210	6	733
Measuring instruments in Elmira .....	900	6	54
Disconnecting Station on poles at Waterloo .....	200	6	12
	13,310	.....	799
Engineering and Contingencies, 10 per cent. ....	1,331	.....	80
	14,641	.....	879
Interest during construction, 3 per cent. ....	439	.....	.....
	15,080	.....	.....
Interest at 4 per cent., Sinking Fund at 1.8 per cent. on \$15,080...	.....	.....	875
Line loss, 8 H.P., at \$9.40 .....	.....	.....	75
Operating, at \$40 per mile .....	.....	.....	440
Total Annual Cost to transmit 225 H.P. ....	.....	.....	2,269

Cost per H.P., \$10.08. Total cost of power to Elmira: \$24.50 + \$10.00 = \$34.58. Total cost per H.P. to build, \$67.02.

## ESTIMATE NO. 4.

*Cost of Distribution in Elmira.*

	Capital Cost.	%	Annual Charges.
Material needed in Station:	\$		\$
1 Incoming Line Panel, 13,200 V., at \$600 .....	600	6	36
2 Sets Disconnecting Switches, 13,200 V. ....	180	6	11
3 100 K.W. 13,200/2,200 V. step-down Transformers ....	4,200	6	252
3 2,200 V. outgoing fender panels, at \$400 .....	1,200	6	72
3 Sets of 2,200 V. Lightning Arresters, at \$50 ..	150	6	9
1 Potential Transformer on 2,200 V. busbars .....	50	6	3
1 Indicating Voltmeter .....	51	6	3
1 Set of 13,200 V. Lightning Arresters .....	300	6	18
1 Set of 13,200 Choke Coils .....	260	6	16
Copper wiring in Station .....	50	6	3
	7,041	6	423
Station of brick, about 30 feet by 20 feet by 15 feet high .....	1,500	2	30
Material needed for Power Distribution:			
144 Poles, at \$10, erected with cross arms and braces ..	1,440	8	115
470 Insulators, at 25c. erected .....	118	5	6
7,065 lbs. of Copper at 20c., erected, weatherproof .....	1,413	2	28
Incandescent Distribution on basis of 900-16 c.p., connected up at \$5.50 per 16 c.p. ....	4,950	6	297
Street Lighting on a basis of 80-32 c.p., 110 V., Tungsten lamps, connected in groups on service transformers, and switched on in groups at dusk, at \$12.50 per lamp .....	1,000	24	240
	17,462	.....	1,139
Interest at 4½ per cent., Sinking Fund at 1.8 per cent .....	.....	.....	1,100
Administration and Labor .....	.....	.....	850
Power cost per annum, 225 H.P., at \$33.58 .....	.....	.....	7,781
	.....	.....	10,870

*Norwich and Tillsonburg:* Applications were received from the towns for price on a supply of power. At Woodstock was the nearest transformer station, estimates were made of the cost of transmitting power to Norwich and Tillsonburg from Woodstock at 13,200 volts. These estimates as printed herewith were sent to these towns.

January 6th, 1909.

### ESTIMATES FOR NORWICH AND TILLSONBURG.

A number of comparative estimates have been made for different amounts of power delivered at Norwich and Tillsonburg.

Power is transmitted from Woodstock at 13,200 volts, 25 cycles, and is switched directly from the busbars in the Woodstock transformer station. For ten miles the power is transmitted over a double circuit line, open-air switches being placed on the end of the line, and branches run to Norwich and Tillsonburg. Single circuit lines for 300 horse power and double circuit lines for 400 horse power and over. The power is transformed at Norwich and Tillsonburg to 2,200 volts.

The cost of power at Woodstock busbars taken at \$23.50.

#### SCHEME (A)

Tillsonburg, 300 H.P.

Norwich, 300 H.P.

—	Capital Cost.	Annual Charges.	Cost per H.P.
	\$	\$	\$ c.
Tillsonburg .....	29,466	4,238	37.63
Norwich.....	23,216	3,392	34.81

#### SCHEME (B)

Tillsonburg, 300 H.P.

Norwich, 300 H.P.

—	Capital Cost.	Annual Charges.	Cost per H.P.
	\$	\$	\$ c.
Tillsonburg .....	27,970	4,058	37.03
Norwich.....	28,506	4,122	33.80

#### SCHEME (C)

Tillsonburg, 300 H.P.

Norwich, 500 H.P.

—	Capital Cost.	Annual Charges.	Cost per H.P.
	\$	\$	\$ c.
Tillsonburg .....	26,919	3,940	36.63
Norwich.....	31,128	4,558	32.62



## SCHEME (D)

Tillsonburg, 500 H.P.

Norwich, 300 H.P.

—	Capital Cost.	Annual Charges.	Cost per H.P.
	\$	\$	\$ c.
Tillsonburg.....	40,178	5,755	35.01
Norwich.....	20,669	3,094	33.81

## SCHEME (E)

Tillsonburg, 500 H.P.

Norwich, 400 H.P.

—	Capital Cost.	Annual Charges.	Cost per H.P.
	\$	\$	\$ c.
Tillsonburg .....	38,694	5,588	34.68
Norwich.....	25,947	3,557	33.14

## SCHEME (F)

Tillsonburg, 500 H.P.

Norwich, 500 H.P.

—	Capital Cost.	Annual Charges.	Cost per H.P.
	\$	\$ c.	\$ c.
Tillsonburg .....	37,631	5,474	34.45
Norwich.....	28,581	4,281	32.07

## SCHEME (G)

Tillsonburg only, 300 H.P.

—	Capital Cost.	Annual Charges.	Cost per H.P.
	\$	\$	\$ c.
Tillsonburg.....	32,416	4,642	38.97

## SCHEME (H)

Tillsonburg only, 500 H.P.

—	Capital Cost.	Annual Charges.	Cost per H.P.
	\$	\$	\$ c.
Tillsonburg .....	46,715	6,524	36.55

The above Capital Cost and Annual Charges are additional costs after leaving Woodstock for transmission and transformation.

For power at 12,000 volts at the town limits instead of power of 2,200 volts, the above cost per horse power can be reduced as follows, for the different amounts of power taken:

For 300 H.P., costs per H.P. reduced by .....	\$3.25
" 400 H.P. " " " " .....	3.50
" 500 H.P. " " " " .....	4.00

A power canvass was afterwards made of this district, and, using this as a basis, we estimated that Norwich could safely contract for 150 H. P. and Tillsonburg for 500 H. P. Assuming that contracts for this power are made, and that Springford will take 25 H. P. and New Durham 50 H. P., the cost of power to Norwich would be \$36.54 per H. P. per year, and the cost to Tillsonburg, \$35.94; Springford, \$32.43, and New Durham, \$62.56. Omitting New Durham from the line, the cost of power to Norwich would be \$39.26 per H. P., the cost to Tillsonburg would be \$36.40 and to Springford, \$32.89.

*Norwich:*

An estimate was made as follows, giving the first cost and annual charges of a distribution station.

ESTIMATE OF COST OF DISTRIBUTION STATION IN NORWICH, 150 H.P.

	First Cost.	%	Annual Cost
	\$		\$
Cost of station 18 ft. x 20 ft. x 18 ft. high.....	1,300	2	26
Cost of line entrance .....	25	5	1
1 set 13,200 V. Lightning Arrester .....	540	6	32
1 " " Choke Coils .....	240	6	14
1 " " Disconnecting Switches .....	75	6	5
1 T. P. S. T. hand operated oil switch 13,200 V.....	390	6	23
3 50-K.W. 13,200/2,200 V. step-down O.I.S.C. transformers .....	1,860	6	112
1 hand operated sw. bd. type 2,200 V., T.P. S.T. oil switch.....	175	6	11
3 2,200 Volt Lightning Arresters .....	75	6	5
1 Switchboard Panel with Indicating Instruments .....	400	6	24
	5,080	.....	253
Engineering and contingencies, 10% .....	508	.....	25
	5,588	.....	273
Interest during construction, 3%.....	168	6	10
	\$5,756	.....	288
Interest at 5% and Sinking Fund at 1% on \$5,756 .....		.....	391
Labor and attention at \$25 per month.....		.....	300
Lost power (5% of 150 H.P. at \$23).....		.....	173
Cost of distribution station per year.....		.....	1,152

Cost per H.P. per year—\$7.68 to be added to the cost of power at Norwich.

*North Toronto:* Detailed estimates were made on street lighting as follows, and a map prepared showing the locations of the proposed lamps. These estimates were sent to North Toronto.

## ESTIMATE NO. 1.

First cost and annual charges on an underground line from the high level pumping station to the corner of St. Clair Ave. and Yonge Street.

	First cost.	%	Annual Cost.
6,000 ft. cable-duct installed at \$1.20 per lineal foot (4 duct).....	\$ 7,200	2	\$ 144
12 manholes at \$160 each .....	1,920	5	96
6,000 ft. No. 4 H. & S. 13,200 V., 3-phase cable at 50c.....	3,000	6	180
3 Lightning Arresters at Yonge and St. Clair.....	350	6	21
	13,470	.....	441
Engineering and contingencies, 10%.....	1,347	.....	44
	13,717	.....	485
Interest during construction, 3%.....	412	.....	.....
	14,129	.....	.....
Interest and Sinking Fund at 6.3% on \$14,129. ....	.....	.....	390
Total annual charges.. ....	.....	.....	1,375

## ESTIMATE No. 2.

First cost and annual charges on the line from Yonge and St. Clair to the Pumping Station on Sherwood Ave. (13,200 volts).

The poles already on Yonge Street can be used, and the poles on Sherwood Ave. are included in the distribution estimates, so that there will be needed for this:—

	First Cost.	%	Annual Charges.
Extra cross arms, pins, insulators, etc., on poles already covered on Yonge street and Sherwood avenue, 163 poles at \$3 per pole..	\$ 489	6	\$ 29
40,950 ft. No. 4 copper, one circuit, at 126 lbs. per 1,000 ft. at 20c. per lb. erected .....	1,032 50	2 6	21 3
Line hardware and guys.....	1,200	6	72
1 Incoming Line Panel 13,200 V.....	680	6	41
1 Set 13,200 V. Arresters with Coke coils.....	50	6	3
1 13,200 V. Line Entrance.....			
	3,501	.....	169
Engineering and contingencies, 10% .....	350	.....	17
	3,851	.....	186
Interest during construction, 3%.....	116	.....	.....
	3,967	.....	.....
Note—If the station is located at Montgomery and Yonge there would be the following reductions:—			
19,200 ft. of wire .....	484	2	10
Extra cross arm, etc, 40 poles at \$3.....	120	6	7
	604	.....	17
Engineering and Contingencies, 10 per cent.....	60	.....	2
	664	.....	19
Interest during Construction, 3 per cent.....	20	.....	.....
	684	.....	.....
We will continue with the assumption that the station is to be at the Pumping Plant.			
Interest and Sinking Fund, 6.3 per cent. on \$3,967.....			250
Total Annual Charges .....			436



ESTIMATE No. 3.

First cost and annual charges on the station and distributing system.

	First Cost.	%	Annual Charges.
	\$		\$
Cost of addition to the Pumping Station.....	1,000	1	10
921 Poles, complete, erected with bolts, nuts, crossarms, etc., at \$11, erected .....	10,131	6	608
1,517 Insulators, with Pins, erected, at 25c .....	379	6	23
144,450 feet No. 6 copper wire, bare, at 80c. per 1,000 feet, and 20c. per lb., erected .....	2,311	2	46
Line Hardware, etc.....	100	6	6
2,100 light capacity, 13,200 V., primary; 4 ampere rectifier equipments, complete, with all details, erected complete, at \$6,200 each.....	12,400	6	744
180 Metallic flame arc lamps erected, complete, with cut-outs at \$47.50.....	8,550	6	513
Wiring and busbars in station .....	100	6	6
	34,971		1,956
Engineering and Contingencies, 10 per cent.....	3,497		196
	38,468		2,152
Interest and Sinking Fund, at 6.8 per cent. on \$39,622.....	1,164		
	39,622		
Interest and Sinking Fund at 6.3 per cent. on \$39,622.....			2,496
			4,648

ESTIMATE No. 4.

*Annual cost of operating 175 Lamps.*

Estimate No. 1—Underground Line .....	\$1,375
“ “ 2—Overhead Line.....	436
“ “ 3—Station Equipment and Distribution System.....	4,648
Operation of Station—Labor .. ..	900
Cost of Power—104 H.P., at \$25 . . . . .	2,600
Cost of Lost Power—5 H.P., at \$25 .....	125
Renewals, at \$5.75 lamp.....	1,006
Total Operating Cost.....	\$11,090
Annual cost per lamp, \$63.37.	
Capital cost per lamp, \$329.82.	
Interest is figured at 5 per cent., and Sinking Fund Charge at 1.8 per cent. (retiring in 30 years), making a total of 6.3 per cent.	

*Dundas:* This town asked for a price on power and the cost of distribution, etc. We also gave them an engineering report on the present franchise of the Cataract Power Co. We have given them information to use in passing a by-law authorizing the Council to contract for power.

*Paris:* A request was made for estimate and for the visit of an engineer to the municipality to ascertain the power conditions.

*Burford Village:* Application was made through resolution of their Council for a price of not less than 50 and not more than 100 horse power delivered at the village.

*Port Stanley:* Application was made for a price of power delivered to the municipalities. The estimates will be made up and submitted immediately.

Out of the municipalities that have contracted for power, Toronto, Guelph, Berlin, Woodstock and London, all have their own engineering departments who are planning the work and apparatus for their system. We have given help to all the municipalities on many questions, as follows:—

July 28th, 1909.

### BERLIN.

#### ESTIMATE OF OVERHEAD LINE FROM COMMISSION'S STATION TO BERLIN STATION. 4,600 FEET—13,200 VOLTS.

60 Poles, 40 feet high, complete with cross arms for double circuit, three-phase line, and also bolts, nuts and braces, at \$15 each (octagon shape, painted), erected ...	\$900
378 Insulators, complete, with pins, at 35c., erected .....	132
29,000 feet No. 0. B. & S. bare copper wire, No. 338, at 30c. per lb. ....	1,960
Extra line hardware, etc. ....	200
Two sets 13,200 volt electrolytic lightning arresters, at \$336. ....	672
Two sets 13,200 volt choke coils, \$120 .....	240
	<hr/>
	\$4,104
Engineering and Contingencies, 10 per cent. ....	410
	<hr/>
	\$4,514
Interest during Construction, 3 per cent. ....	135
	<hr/>
	\$4,649

#### ESTIMATE OF UNDERGROUND LINE FOR COMMISSION'S STATION TO BERLIN SUB-STATION.

4,600 feet of 4 duct conduit at 75c. per duct foot .....	\$3,450
Ten manholes, at \$100 each .....	1,000
9,200 feet No. 9. B. & S. lead covered, 3-phase cable at 70c. per foot. ....	6,440
	<hr/>
	\$10,890
Engineering and Contingencies, 10 per cent. ....	1,089
	<hr/>
	\$11,979
Interest during Construction, 3 per cent. ....	359
	<hr/>
	\$12,338

*Toronto:* Considerable work has been done in surveying rights-of-way to the Toronto station, and the plans and specifications drawn up by the City Engineering Department, for station equipment, conduits, etc., and the methods of charge for power and lighting have been considered and our advice given.

*Guelph:* An estimate of the cost of power to Guelph under the present contract with varied demands for power was made. The requirements of the Guelph Agricultural College were investigated and a report made.

*Berlin:* Comparative estimates of the cost of overhead and underground lines from the Commission station to the municipal station have been made for their use.

*Woodstock:* Some work has been done in arranging the Commission's station and the city station for operation as a unit.

*London:* Several estimates of the cost of power to the London Street Railway Co., under different conditions, were made for the city.

An estimate of the cost at the lines between the Commission's station and the city station were made on the basis of all overhead construction composed with a line partly overhead and partly underground. An estimate was also made of the cost of the transmission lines between the Commission's station and the South-Western Traction Company's power house, Asylum and the city's east end stations.

*Hamilton*: Estimates were made of the cost of power to Hamilton on the basis of the following demands:

Demand.	Total cost per h.p.	Sinking Fund charge.
1,000 h.p.	\$17.92	\$1.52
1,500 h.p.	17.50	1.39
2,000 h.p.	16.65	1.26
2,500 h.p.	16.13	1.19
3,000 h.p.	15.79	1.14
4,000 h.p.	15.55	1.13

Some of the municipalities have not been in a position to proceed with plans, owing to various reasons, and those towns have had help in various ways.

Ingersoll has been visited many times in an endeavor to help them in their consideration of local questions. Estimates have been made of the cost of power distribution, and these are now being used as the basis of a money by-law which will be voted on early in January. The situation in Ingersoll is peculiar and we have made many efforts to solve it.

*Galt* has been visited many times and help given them in their efforts to solve their local difficulties. We recommended an engineer to give them an estimate of the value of the present plant. This has been made, and negotiations to purchase the local plant are now in progress.

*New Hamburg* has decided to secure by purchase the plant now operating in that town, if a favorable price can be made, and to that end has asked us to recommend an engineer to give them a valuation. This engineer is now engaged on this work. Several visits have been made to the town to give them information and aid.

The following municipalities have requested the Engineering Department of the Commission to act as consulting engineers:

*Waterloo* was visited many times and data secured for making up a proposed distribution system. Arrangements have been made to take over the local plant by purchase. The Council has been granted the services of the Engineering Department of the Commission to act as their consulting engineers, and a proposed station, and the apparatus to be used therein, has been laid out for them. Applications for tenders for this apparatus are now being drawn up. The station is being built.

*Hespeler*: Estimates have been made for this town on power distribution and station apparatus cost as follows. Hespeler has been granted the services of the Engineering Department to act as their consulting engineers, and the specifications and form of tender for their apparatus are now being drawn up.

#### DISTRIBUTION ESTIMATES FOR HESPELER.

Power will be delivered by the Hydro-Electric Power Commission to Hespeler at the Hespeler municipal station over a single three-phase line, using on Main Street the poles to be erected by the municipality.



The power for the Forbes Woollen Mills will be tapped off from this main line where it passes the mills.

The 6,600 volt line will run on the north side of Main Street and will cut across the river to the municipal station.

We have made two estimates as follows:—

Estimate No. 1.—Cost of an extension to the present building, and cost of station apparatus.

Estimate No. 2.—Cost to distribute power, including feeder panel, etc., and poles on Main Street.

New poles have been estimated on in all cases, although some of the present poles might be used to carry the power distribution wires.

The synchronous motor figured on in Estimate No. 1 operates from 6,600 volt busbars.

HESPELER.

ESTIMATE NO. 1.

	Capital Cost.	%	Annual Charges.
	\$		\$
Extension to present building .....	500	2	10
1 Incoming 6,600 V. Line Panel .....	780	6	47
1 Set Disconnecting Switches .....	45	6	3
1 Set 6,600 V. Lightning Arresters .....	265	6	16
1 Set 6,600 V. Choke Coils .....	150	6	9
2 Bus Potential Transformers .....	302	6	18
1 Voltmeter .....	50	6	3
6,600 Volt Busbars and wiring .....	100	6	6
1 6,600 V. 100 K. V. A. Synchronous motor to drive present gener- ator .....	3,800	6	228
Station Wiring and Labor .....	200	6	12
	6,192	.....	352
Engineering and Contingencies, 10 per cent. ....	619	.....	35
	6,811	.....	387
Interest during Construction, 3 per cent. ....	204	.....	.....
	7,015	.....	.....

HESPELER.

ESTIMATE NO. 2.

	Capital Cost.	%	Annual Charges.
	\$		\$
71 poles completely equipped with cross arms, etc., at \$11.00, erected .....	781	8	63
100 Insulators, with pins erected, at 25c. each .....	25	6	2
7,212 feet No. 6 copper, bare, at 100 lbs. per thousand feet, at 20c. erected .....	144	2	3
Guys, line hardware, etc. ....	25	6	2
1 6,600 V Power Feeder Panel .....	600	6	36
1 Set Lightning Arresters, at 6,600 V., complete with choke coils..	415	6	25
	1,990	.....	131
Engineering and Contingencies, 10 per cent. ....	199	.....	13
	2,189	.....	144
Interest during construction, 3 per cent. ....	66	.....	.....
	2,255	.....	.....



## SUMMARY.

Estimate No. 1.....	\$7,015	\$337
Estimate No. 2.. .....	2,255	144
	<u>\$9,270</u>	<u>\$531</u>
Interest, 5 per cent.; Sinking Fund, 1.8 per cent. ....		630
		<u>\$1,161</u>

*Preston:* An estimate was made of the cost of station apparatus and line material as follows:—

*Estimate of material and apparatus required to run a 2,200 volt power line from city station to power users:*

Assuming that a new 2,200 volt, 25 cycle three-phase power circuit is to be run from the power house to the power users listed, the following material and apparatus would be needed. The main line runs from the station south-east on King Street to Union Street, with a branch on Eagle Street to the mills and the car company, and a second branch on Guelph Street to Ballantyne's. We have estimated on all new poles and step-down transformers for all power users, and reductions can be made for such of the present poles as can be used for the power users who can use 2,200 volt power and therefore would not need transformers.

	Capital Cost.	%	Annual Charges.
Conductors, 7,398 lbs. at 20c. D.B. Weatherproof.....	\$ 1,480	2	\$ 30
96 poles at \$11, erected with cross arms.....	1,056	2	24
318 Insulators at 25c., erected with pin .....	20	6	5
Transformers .....	4,101	8	328
11 Sets of Lightning Arresters at \$25 .....	275	6	17
11 " " Fuses at \$12 .....	132	6	8
Extra line hardware, etc....	100	6	6
Engineering and contingencies, 10% .....	722	.....	48
	<u>7,946</u>	.....	<u>526</u>
Interest during construction, 3%.....	238	.....	.....
	<u>8,184</u>	.....	<u>557</u>
Interest, 5%; Sinking Fund, 1.8%.....	.....	.....	1,083

*Estimate of Apparatus and Material in the City Station.*

	Capital. Cost.	%	Annual Charges.
1 Incoming line panel .....	\$ 780	6	\$ 47
2 6,600 V. Bus Potential Transformers.. ..	150	6	9
1 Voltmeter on busbars .....	50	6	3
1 Set Disconnecting Switches .....	90	6	5
Busbars and wiring .....	100	6	6
Line Entrance. ....	50	6	3
1 Power Feeder Panel, 2,200 V. ....	400	6	24
1 Set 2,200 V. Lightning Arresters.....	100	6	6
1 Panel for the control of Magnetite Equipment. ....	400	6	24
1 2,200 V. Magnetite Equipment for 50 Lights.....	2,000	6	120
1 Synchronous Motor Feeder Panel, at 6,600 V. ....	600	6	36
1 6,600 V. Synchronous motor for driving present 60 cycle generator. ....	2,800	6	168
1 Feeder Panel (2,200 V.) for motor or pump....	400	6	24
1 Transformer Panel, 6,600 V.....	600	6	36
1 Bank of 3-100 K.W. 6,600/2,200 V. Transformers .....	3,500	6	210
Engineering and Contingencies, 10%.....	1,202	6	72
	13,222	.....	793
Interest during Construction ... ..	397	6	24
	13,619	.....	817
Interest, 5%, and Sinking Fund, 1.8%.....		.....	923
		.....	1,743

The Engineering Department is now acting as consulting engineers for the town of Preston by the consent of the Commission and at their request. Tenders for the electrical apparatus have been secured and orders should be placed very soon.

*Stratford:* Data have been gathered and estimates made upon the power distribution system and the apparatus needed in a sub-station. Efforts have been made to buy up the local plant and an arbitration board has been appointed to determine a valuation. The situation has called for considerable of our time and attention. We are now by the request of the Council acting as their consulting engineers.

STRATFORD.

*Station Equipment.*

	First Cost.	%	Annual Charges.
4 Sets 13,200 V. Disconnecting Switches, at \$50 .....	\$ 200	6	\$ 12
2 " " Lightning Arresters, at \$350 .....	700	.....	42
2 " " Choke Coils, at \$125 .....	250	6	15
2 Incoming Line Panels, at \$1,000 .....	2,000	6	120
2 13,200/110 V. Potential Transformers, at \$170 .....	340	6	21
2 150 Volt Voltmeters, at \$45 .....	90	6	5
3 50 Light Magnetite Equipments, 13,200 V., complete, with panels, etc .....	7,000	8	560
1 Transformer panel for 13,200 V. side .....	600	6	36
3 100 K.W. Transformers 13,200/2,200 V. at \$1,000 .....	3,000	6	180
1 Synchronous motor panel at 13,200 V. ....	1,000	6	60
1 225 K.W. 13,200 V. Synchronous Motor .....	6,000	6	360
2 2,200 V. Feeder Panels, at \$500 .....	1,000	6	60
1 2,200/110 V. Potential Transformer .....	60	6	4
Labor in Station .....	200	6	12
New Machine Foundations, etc .....	500	1	5
Busbar wiring, etc .....	250	6	15
	23,190	.....	1,507
Engineering and Contingencies, 10 per cent. ....	2,319	.....	151
	25,509	.....	1,658
Interest during Construction, 3 per cent. ....	765	.....	.....
	26,274	.....	.....

STRATFORD.

*Line Equipment.*

	First Cost.	%	Annual Cost.
381 Poles, at \$12 each, erected with cross arms .....	\$ 4,572	6	\$ 274
1,201 Insulators, erected with pins, at 35c. ....	421	8	34
9,985 lbs. of Copper Conductor, bare, erected, at 20c. per lb. ....	1,997	2	40
Extra line hardware .....	200	6	12
100 Magnetite Arc Lamps, 4 amps., complete, with cut outs and hangers, at \$40 .....	4,000	6	240
100 Series Tungsten Lamps, at \$2.25, plus \$1.25 installation .....	350	.....	.....
100 Cut Outs for Tungsten units, at \$1.40, plus 35c. installation ....	175	6	11
100 Brackets and Sockets for same, at \$10 .....	1,000	6	60
	12,715	.....	671
Engineering and Contingencies, 10 per cent. ....	1,272	.....	67
	13,987	.....	738
Interest during Construction .....	420	.....	.....
	14,407	.....	.....
Lost Power—10 H.P., at \$9.40 .....	.....	.....	94
	.....	.....	832

## SUMMARY.

	First Cost.	%	Annual Cost.
Station Equipment .....	\$ 26,274	.. .....	\$ 1,658
Line Equipment .....	14,407	.. .....	332
New Incandescent Services .....	4,000	6	240
Remodelling Station .....	2,000	2	40
	46,681	.....	2,670
Interest and Sinking Fund, 6.8 per cent. ....		.....	3,174
		.....	5,844

*St. Mary's:* Many questions have arisen calling for our services to make matters clear to the Fire and Light Committee and to the Council. While the Engineer and the Committee are drawing up the plans for the local distribution system, and for adapting the municipal plant for Niagara power, we have been asked to serve as consulting engineers on many questions in dispute.

*St. Thomas:* As consulting engineers for St. Thomas, we have laid out a complete system for their various services. This has been accepted by them and we are drawing up specifications and applications for tenders. Considerable preliminary work has been done and plans have been made to start work.

## MEETINGS OF MUNICIPAL ENGINEERS.

At our advice and request the electrical engineers or superintendents of the local plants of the various municipalities who have contracted for power, held a meeting in Toronto on September 29th and 30th, to consider engineering questions of general interest to the municipalities. This meeting was a pronounced success and resulted in a decision to hold these meetings as frequently as possible, especially during the time when plans are being made and specifications drawn up. Three of these meetings have been held, each lasting two days, and Mr. Ross, our Consulting Engineer, has acted as Chairman, and a representative from the Engineering Department has acted as Secretary. After each meeting full minutes of same have been sent to each municipality under contract. The Engineering Department has investigated many subjects for the Municipal Engineers and has written reports on them calling for considerable time and attention.

Copies of the minutes and of these reports follow:—

*Minutes of the Joint Meeting of Municipal Engineers and the Hydro-Electric Power Commission, held on Wednesday and Thursday, September 29th and 30th, 1909.*

In accordance with the invitation of the Commission, a meeting of the engineers of the following municipalities and the Commission was held on Wednesday, Sept. 29th, 1909, at the offices of the Commission, Continental Life Building, being afterwards adjourned to Committee Room No. 1 of the City Hall.

The meeting was called to order at 2 p.m. and the municipalities were represented as follows:—

Toronto.....K. L. Aitken.  
 London.....E. I. Sifton.  
 St. Thomas.....Jas. A. Bell, George Gill.  
 Oodstock.....J. S. Archibald.



St. Mary's .....	L. H. Reesor, W. R. Reynolds.
Stratford .....	Mayor Dingman, Mr. Barnett and R. H. Myers.
Guelph .....	E. Richards, J. J. Heeg.
Berlin .....	E. J. Philip, Mayor Hahn.
Hespeler .....	L. E. Weaver.
Waterloo ....	Mayor Weidenhammer.

The engineering interests of Waterloo were looked after by Mr. E. J. Philip, of Berlin, and the interests of Preston, Galt, New Hamburg and Ingersoll by the engineers of the Commission, as these municipalities were not represented.

The Chairman of the Commission, Hon. Adam Beck, welcomed the delegates and gave a short address outlining the reasons for calling the meeting, as summarized in the invitation, and giving a report of the progress of construction work.

After the address a general discussion took place on questions of general interest, the opportunity being used to take up questions of policy regarding existing franchises and regarding the sale of power to interurban railways by the Commission.

Mr. Ross, Consulting Engineer, took the chair and outlined the discussion to be followed and gave a general resume of the questions of interest to be brought up.

The question of voltages was then taken up and a very animated, interesting and careful discussion took place. The main questions discussed were the advisability of distributing overhead at 13,200 volts, the sale of 13,200 volt power, the best voltage for motor power, the proper voltage for incandescent service, and the general questions of power and light distribution.

After lengthy consideration the following resolution was moved by Mr. Sifton, seconded by Mr. Philip: "Whereas the consensus of opinion is that 550 volt for power, 110 and 220 volt for lighting with 2,200 volt for intermediate voltage, where needed, be considered as standard by the engineers; be it resolved that each representative study his local conditions in this connection in order that the difficulties to be surmounted, if any, may be considered at the next meeting." Carried.

The question of frequencies was then discussed and the delegates reported on the proposed action in each municipality, to adapt their present services to 25 cycle power. It was then found that the same general practice was to be followed in each municipality, that where the present service, whether 60 cycles or direct current, is satisfactory it should be maintained driving the generators by a 25 cycle motor, but that all new work, overloads, if any, and the outskirts be served by 25 cycle power for all purposes, gradually reducing the load on the generators by changing over to 25 cycles whenever a transformer is to be replaced, a motor is outgrown or worn out, etc. The ultimate outcome of this gradual elimination of all but 25 cycle services was generally felt to be one for which a solution was not necessary now, and it was therefore moved by Mr. Richards, seconded by Mr. Archibald, "That the meeting felt that practice should tend to 25 cycle for all purposes." Carried.

The subject of Station Transformers was then discussed and after some general talk a resolution was moved by Mr. Richards, seconded by Mr. Archibald, "That the Commission be asked to obtain prices on single-phase and three-phase transformers, and study the question of recommending the use of either for the requirements of the municipalities." Carried.

There was an interesting discussion regarding the use of taps on step-down transformers, which led naturally to the subject of feeder regulators. While it seemed to be the consensus of opinion that feeder regulators would have to be in-

installed after the system was working and its requirements determined, it was decided to postpone further discussion of this subject until the next meeting. Meanwhile the Commission was to ask the Engineers of the municipalities to consider the question—What taps, if any, do you consider advisable on step-down transformers? What proportions should these taps be,  $2\frac{1}{2}$  per cent.,  $3\frac{1}{3}$  per cent., or 5 per cent.? Also should these taps be on the high tension side, low tension side, or both?

The meeting was adjourned at 6 p.m., to meet again next morning at 9 o'clock.

The meeting was promptly called to order at 9 a.m. on the 30th, Mr. Ross presiding.

The meeting was opened by Mr. Sothman giving a talk on the lamps in use abroad. It was learned that tantalum lamps were most satisfactory on 25 cycles, being very substantial, with long life, and were economical in the use of power. The tantalum lamp made by the Siemens, Halske Company could be bought in England and laid down in Canada for about 40 cents.

The question of free renewals of lamps was then begun, and it was found that it is not the general practice. There was no decision on this question though it seemed to be the idea as expressed by Mr. Ross that it was the practice to be recommended. The discussion naturally led up to the question of rates and methods of charging, and after a long discussion in which all the delegates joined, various combined or differential rates being considered, it was conceded that a differential rate was necessary. It was then moved by Mr. Sifton, seconded by Mr. Archibald, "That the municipalities furnish all information available relative to private and commercial lighting in each municipality with the object of enabling a method of charging to be recommended which would be found equitable to all classes, this to include the question of free lamp renewals and meter rents" Carried.

The next subject was street lighting, and many types and methods were discussed. The subject, however, was too large for consideration with data at hand, and the Commission was requested to get all the data regarding the first cost, life, maintenance, energy, cost, etc., of the various systems adapted to 25 cycle power, and report at the next meeting.

At this point Mr. Sothman gave some general relative costs of single-phase and three-phase transformers, showing that three-phase transformers were about 25 per cent. cheaper than the equivalent capacity in single-phase transformers.

The use of synchronous motors on high voltages showed a great difference of opinion, and after some discussion the request was made that the Commission secure comparative costs on the same size motors at the different voltages with further data on the cost of the increased size in transformers for the low voltage motors.

During the talk on lightning arresters which followed, Mr. Sothman and Chief Myers told of conditions in the power house and sub-stations of the 100,000 volt plant at Muskegon. It being conceded that no general rule can be laid down for the use of arresters, it was decided that since local conditions rule, each engineer was to present the conditions applying in any case which he wished to have solved for consideration at the next meeting.

The subject of bulking orders on supplies for line and service work was discussed, and it was conceded that it would be advantageous in many cases to do so. Therefore at the next meeting or at any meeting following, each engineer was to give a list of the material he wished to purchase, so as to buy in large quantities.



Some standard system of accounting being considered advisable, the Commission was requested to report on the system best adapted for use. The system proposed by the N.E.L.A., New York Public Service Commission and the Massachusetts Railway Board, as well as the system used by the Ontario Railway and Municipal Board, are to be considered at the next meeting.

The frequency of these meetings was considered and it was decided that during the next few months meetings should be held often, and at the different municipalities in order to study the local conditions. It was then moved by Mr. Richards, seconded by Mr. Bell, "That the next meeting be held in Toronto on Tuesday, the 12th of October, at 2 p.m."

The meeting was then adjourned.

#### OPINION OF THE ENGINEERING DEPARTMENT OF THE COMMISSION ON THE SUBJECT OF A STANDARD VOLTAGE FOR POWER.

By mutual consent, we may say, this question has resolved itself into a discussion between the advocates of 440 and 550 volts. The former claim the advantage of being able to use the same transformers for light and power service. The advocate of 550 volts claims the prevailing practice, a greater radius of distribution with the same loss, and a lower copper cost.

It seems to us that the question resolves itself into other questions which are up for discussion, and the solution of this question depends on the solution of others. If we are right in saying that the consensus of opinion at the last meeting favored the distribution ultimately of all power at 13,200 volts, the advocate of the 440 volt secondary has lost his argument, for then the transformers would have 13,200 volt primaries, which the lighting transformers would not have. And, too, the power transformers would be concentrated, and therefore much larger than the lighting transformers.

Again, if three-phase transformers for power are adopted, the 440 volt man has lost his argument.

We would advocate the distribution of power at 13,200 volts (6,600 volts for Galt, Preston and Hespeler), the use of three-phase 13,200/575 volt transformers for power, the use of 2,200/220/110 volt single-phase transformers for lighting.

Where a small power user wishes power from the lighting mains supplying him with 220 single or three-phase power using standard lighting transformers. Where larger power user wishes power and you cannot economically or advisedly reach him with your 13,200 volt circuits, sell 2,200 volt power and have him furnish not only motor but transformers, recommending the use of 2,200/575/115 volt transformers.

If these standards were adopted London would be obliged to distribute at 13,200 volts or to purchase a lot of special transformers. Woodstock would be obliged to sell the 440/220 volt secondary 25 cycle transformers now in use and buy others, losing the benefit of the foresight shown during the last two years when buying transformers. The other municipalities would be able to fall in line.

In answer to these two arguments we urge the use of 13,200 volt circuits in London. With the London electric wires, the telephone, telegraph, and a few more, the streets are crowded without new lines and they should *all* go underground. But until the competitive wires go underground the city should not be forced to bear the extra expense. In the meanwhile arrangements can undoubtedly be made to run high voltage lines overhead. We believe this question should be given serious consideration.

In Woodstock's case we believe that the time when the motors are changed from 60 to 25 cycle is the time to change the transformers and line voltage, if any change is ever to be made. We are told that the power is to be 13,200 volt construction with 2,200 volt power until the load warrants 13,200 volt service. If the line is ever to be changed to 13,200 volts now is the time to do it, when the number of transformers is low and the motors have to be changed to 25 cycles, and when the transformers now in use can be sold to other municipalities as lighting transformers.

We have secured comparative costs on service transformers with different secondaries and find that a 10 kilowatt transformer with 2,200 volt primary and 575 volt secondary cost the same as 2,200 / 110 / 220 volt transformers, while a 2,200 / 110 / 220 / 440 volt transformer would cost about 15 per cent. more. Three single-phase 10 kilowatt transformers will cost about 17 per cent. more than a 30 kilowatt three-phase at 2,200 volt primary, 575 volt secondary.

Toronto, October 11th, 1909.

THREE-PHASE VERSUS SINGLE-PHASE TRANSFORMERS. OPINION OF ENGINEERING DEPARTMENT OF THE HYDRO-ELECTRIC POWER COMMISSION.

The results of our investigations are as follows:—

Both Westinghouse and G.E. Company will guarantee either.

G.E. say that if one leg breaks down that leg can be short-circuited, using two other legs, thereby overcoming advantage of single-phase transformers.

Westinghouse say that if reserve is desired two three-phase Station Transformers will cost only 10 per cent. more than four single-phase transformers. One three-phase transformer can be held as a reserve for two or more stations. Galt, Preston, Hespeler, Berlin, and Waterloo, all on the G., P. & H. Railway, could have one common three-phase reserve mounted on a flat to be hauled to any one of the stations. London and St. Thomas could hold reserve in the same way.

We have quotations from the A.B.C. Company on single and three-phase transformers for services, 2,200/575 volts, and in comparing them we find that 3.5 kilowatt cost 9 per cent. more than one 15 kilowatt three-phase. Three 10 kilowatt single-phase cost about 15 per cent. more than one 30 kilowatt three-phase. Three 50 kilowatt cost about 35 per cent. more than one 150 kilowatt three-phase. There is a great money saving in the larger sizes, and in the smaller sizes the advantage of having only one transformer to hang instead of three is worth considering, in addition to the money saving.

Our opinion is to make all station transformers three-phase, with two taps on the primary side, and all power service transformers three-phase 13,200 volt primary, 575 volt secondary, with two taps on the primary side, and all lighting service transformers to be single-phase 2,200 / 220 / 110 volt.

Toronto, October 11th, 1909.

MINUTES OF THE MEETINGS OF MUNICIPAL ENGINEERS, HELD ON TUESDAY AND WEDNESDAY, OCTOBER 12TH AND 13TH, 1909.

In accordance with the resolution passed at the first meeting, held on September 29th, the engineers of the municipalities met on October 12th in Committee Room No. 1 of the Toronto City Hall.

The meeting was called to order at 2 p. m., and the municipalities were represented as follows:—



London . . . . .	E. I. Sifton, Ald. Stewart.
Woodstock . . . . .	C. Archibald.
St. Mary's . . . . .	L. H. Reesor, W. R. Reynolds.
Stratford . . . . .	R. H. Myers, Mr. Barnett.
Guelph . . . . .	J. J. Heeg, R. Richards.
Berlin . . . . .	E. J. Philip.
Hespeler . . . . .	L. E. Weaver.
Toronto . . . . .	E. Richards.
Galt . . . . .	E. B. Merrill.

The interests of Waterloo were looked after by Mr. Philip, while St. Thomas, Preston, Ingersoll and New Hamburg were represented by the Engineers of the Commission.

Mr. Ross, the Consulting Engineer of the Commission, was asked to take the chair, and the meeting at once began the consideration of engineering questions. The reading of the minutes of the last meeting was dispensed with, as a full report of the previous meeting had been mailed to each municipality.

### *Secondary Voltages.*

The first subject was that of secondary voltages for light and power. Final decision on this subject had been postponed from the former meeting to allow each engineer to study local conditions to determine whether he could comply with the present standard. A report on the subject by the Engineering Department of the Commission, which may be summarized as follows:—We would advocate the distribution of power at 13,200 volts (6,600 volts for Galt, Preston and Hespeler), the use of three-phase 13,200/575 volt transformers for power, and the use of 2,200/220/110 volt single-phase transformers for lighting. Where a small power user wishes power from the lighting mains, supply him with 220 volt single-phase power, using standard lighting transformers. Where a larger power user wishes power and you cannot economically or advisedly reach him with your 13,200 volt circuits, sell 2,200 volt power and have him furnish not only motor power but transformers, recommending the use of 2,200/575 volt transformers.

During the discussion it was found that London could use 550 volt secondary, Woodstock could do so if the other municipalities took some of their present 25 cycle 2,200/220/110 volt transformers off their hands. It was also decided that 550 volt power could be made safe for all factory work.

The report was finally adopted, with the following amendments:—

It was considered inadvisable to run higher than a one horse power single-phase motor on the lighting transformers.

It was considered inadvisable to run higher than a ten horse power motor on the 2,200 volt lighting mains if the motor is to be on during lighting hours.

No limit in size is necessary if the motor is to operate only during restricted hours.

### *Frequency.*

The decision of the last meeting on this subject was confirmed, and it was decided that practice should tend toward 25 cycle power for all purposes.

### *Single vs. Three-Phase Transformers.*

This decision, also postponed from last meeting for further data, was opened by reading the report of the Engineering Department. Their discussion summarized was, all station transformers should be three-phase with two taps on the primary side, all power service transformers three-phase 13,200 volts primary, 575

volts secondary, with two taps on the primary side, and all lighting service transformers to be single-phase 2,200/220/110 volts. (Percentage of taps under subsequent heading.)

During the discussion the question of weights and sizes as well as prices were considered, and it being found necessary to secure further data the subject was postponed to the following day.

#### *Taps on Transformers.*

This discussion was opened by reading the opinion of the Engineering Department, which summarized was:—We advise the use of two taps on the primary side only, arranged for normal voltage,  $2\frac{1}{2}$  per cent., 5 per cent. and  $7\frac{1}{2}$  per cent. below.

As these taps were for boosting only, the question of lowering taps was discussed and dismissed as unnecessary when Mr. Sothman advised that the normal voltage sent out from the Commission stations would always be as near 13,200 volts as the taps on their 110/000/132 volt transformers would allow. It was then decided that on the understanding that the Commission will furnish 13,200 volt power at their stations, that their recommendations regarding transformer taps be accepted, to apply to both station and 13,200 volt power service transformers.

It was also decided that all 13,200 volt transformers be specified to have two coils so that they may be standard with the transformers for the 6,600 volt circuits.

#### *Feeder Regulators.*

This subject was discussed for some time, advocates for and against the desirability of installing them from the start being strong in their opinions, and it was finally decided that the meeting should recommend that feeder regulators be installed on all lighting feeders but not for the power feeders, and if not installed at present that all arrangements be made for future use.

#### *High vs. Low Voltage Synchronous Motors.*

The Engineering Department reported that on the small sizes which would be used in most of the municipalities the cost of the high voltage motor would be more than the cost of a 2,200 volt motor with the cost of the increased size of transformers added. On the large sizes the high voltage motors would be cheaper. As Mr. Sothman had expressed a wish to discuss this question the subject was postponed.

The meeting then adjourned to meet again at 8 p.m.

Mr. Ross called the meeting to order at 8 p.m., the same delegates being present, except Mr. Weaver, of Hespeler.

#### *Single vs. Three-Phase Transformers.*

Mr. Reynolds and Mr. Philip during the intermission had secured some data from a publication on the comparative weights of these transformers, which showed that in small sizes the weight of a three-phase transformer (without oil) was greater than three single-phase transformers, while the reverse was true if the weights of the oil were added. This caused general discussion, as it was contrary to the general belief, and it was finally postponed until the next day, when it was hoped to have greater data to work on.

After some general talk on various subjects the question of street lighting was begun.

### *Street Lighting.*

This subject was opened by reading the report of Engineering Department. Summarized this report reads:—The art of street lighting is in a transitory stage, due to the growing belief in small units closely spaced. The time since last meeting was too short to allow proper report being made up. Suggested that a committee be appointed to make up a report and to invite experts from the manufacturing companies to offer recommendations at the next meeting.

A very interesting discussion resulted, which showed that the consensus of opinion favored incandescent lamps properly spaced, but the method of wiring and control was not determined. Finally the Engineering Department was asked to write the City Engineering Department of Boston for a copy of the report made by them covering the experiments and tests they conducted previous to accepting Magnetite lamps as their standard.

It was also decided to approve the report of the Engineering Department and appoint the committee suggested, leaving to the committee the arrangements for the trip, but requesting the report to be made as soon as possible.

### *High vs. Voltage Synchronous Motors.*

As Mr. Sothman was able to attend this session this subject was again brought up for final discussion, and it was finally decided that owing to the small sizes of motors needed, the fairly temporary use for these motors, the present state of the art of designing high voltage synchronous motors, and considering that for small sizes the low voltage sets are cheaper, be it resolved that the meeting recommend the use of the lower voltage units.

During this discussion the question of pump motors for London was taken up, and it was decided that synchronous motors should be used, and if separate power and light circuits are used from the Commission's station to the city station, the motors should be on the power circuit.

The meeting then adjourned to meet again next morning at 9 o'clock.

Mr. Ross called the meeting to order at 9.10 a.m., the same delegates being present, with the exception of Alderman Stewart, of London.

### *13,200 Volt Insulators.*

Several samples of insulators were presented, and after considerable discussion the Ohio Brass Company's type No. 10044 was approved. An estimating price of 19 cents each had been given on these. The delegates gave their demands as follows:—Berlin 1,000; Guelph 1,000; Woodstock 100; St. Mary's 350; and London 3,500. The number needed by Stratford, St. Thomas and Preston would be secured. It was then resolved that the Commission secure quotations on 3,000, 7,500 and 13,000, f.o.b. some central point.

Under the same heading discussions were held on Cross Arms, Steel vs. Wood Pins, and Braces and Bolts.

### *Cross Arms.*

Were considered to be too special to bulk orders, each municipality having special requirements as to length and spacing, but it was decided cross arms should be long-leaf yellow pine and painted with two coats of good paint. Treated cross arms not considered necessary.



*Steel vs. Wood Pins.*

This was settled in favor of a good wood pin. Mr. Sothman preferred an all-steel pin and asked to be placed on record. Mr. Ross voiced the sentiments of the other representatives by deciding on wood pins for any voltage below 20,000 volts.

*Braces and Bolts.*

A Commission was asked to secure tenders on standard braces and through bolts.

*Auditing.*

Under this heading the Engineering Department presented copies of accounting systems and reports from the Public Service Commission of New York State, the Railroad Commission of Wisconsin, The Gas and Electric Light Commission of Massachusetts, and the Ontario Railway and Municipal Board.

These were considered, and then it was resolved that the towns authorize their auditors to meet and draw up a system of accounting to be submitted to a joint meeting as soon as possible.

*Rates For Incandescent Lighting.*

This discussion was opened by the consideration of lamp renewals. Berlin, Guelph and Woodstock furnish free renewals. It was considered advisable to furnish free renewals, but rates must be made to cover this. This began a discussion on rates. There were many variations of the Toronto plan considered, but they all amounted to some type of differential rate. The two plans considered best were to charge a monthly charge based on the number of rooms kilowatt hour rate, and, second, a fixed monthly charge based on the floor area of the house and a kilowatt hour rate. After a long discussion Messrs. Philip, Sifton and Archibald were appointed a committee to get an example of rates from all the municipalities and compare them, and compare estimated results of the various plans.

*Grounding of Neutrals.*

It was decided that all neutrals should be grounded.

*Single vs. Three-Phase Transformers.*

It was found that the manufacturing companies were not prepared to give full data of three-phase service and station transformers at the voltage desired, so this question was postponed for discussion at the next meeting. Meanwhile any municipality desiring to expedite the matter is to ask for tenders—and the Commission will secure general data on the subject.

*Next Meeting.*

It was decided that the next meeting was to be held in Preston, October 26th and 27th.

The meeting then adjourned.



MINUTES OF THE THIRD MEETING OF MUNICIPAL ENGINEERS, HELD IN PRESTON  
ON TUESDAY AND WEDNESDAY, OCTOBER 26TH AND 27TH, 1909.

In accordance with the resolution passed at the second meeting, held in Toronto on October 12th, the engineers met on October 25th in the Council Room of the Preston Town Hall.

The meeting was called to order at 2 p.m., and the following were present:—

R. A. Ross.....	Consulting Engineer of the Commission.
J. S. Archibald ..	Woodstock.
E. I. Sifton .....	London.
J. J. Heeg.....	Guelph.
Mayor Weidenhammer .....	Waterloo.
Mr. Cross.....	Waterloo.
R. H. Meyers.....	Stratford.
Mr. Barnett.....	Stratford.
L. R. Reesor .....	St. Mary's.
W. R. Reynolds .....	St. Mary's.
Reeve Schwackhammer.....	New Hamburg.
J. Lappin .....	Preston.
P. B. Yates .....	Engineering Dept. of the Commission.

Mayor Mullen welcomed the representatives to Preston and tendered them the freedom of the town, wishing them success in their efforts and stating that Preston was trusting to their efforts to make each plant ultimately a success.

Mr. Ross was asked to take the chair, and the meeting was called to order. The minutes of the last meeting were not read, as each delegate had received a full report of the meeting.

*Braces, Bolts and Insulators.*

The discussion on bolts and braces was postponed. Quotations were read from the Locke Insulator Manufacturing Company, and the Ohio Brass Company on 8,350 insulators for 13,200 volt service. The quantities and destinations asked for were as follows:—

Stratford 1,200; Berlin 1,000; Guelph 1,000; Woodstock 100; St. Mary's 350; London 3,500; St. Thomas 1,200.

After a general discussion it was decided that the tender of the Ohio Brass Company was the best, and then insulator type No. 10044 was adopted. A copy of the tender was to be sent to the various municipalities with the request that they send their order for insulators to the Commission at the earliest possible date.

*Standard Accounting System.*

No action having been taken by the auditors of the municipalities in accordance with the decision on this subject at the last meeting, Mr. Reynolds moved that the secretary write to the municipalities interested asking them to have their auditors arrange a meeting, look over the systems collected, draw up a general system and be able to report at the next meeting of the Engineers.

*Street Lighting.*

The committee appointed at the last meeting to look up this subject reported their inability to investigate this matter and asked for further time. Arrangements had been made to finance the expenses of the committee and plans had been made to start on this report the 3rd of November.

*Single or Three-Phase Transformers.*

The Engineering Department reported that the companies apparently were not prepared to give data on three-phase transformers, as it had been impossible to secure anything more than general data from the manufacturing companies.

There was considerable discussion, but no attempt was made to reach a decision. It was finally postponed until next meeting, when some of the municipalities would have received tenders on both types.

Under this head there was some discussion regarding the taps on 13,200 volt transformers when used on 6,600 volt lines, and after considerable discussion it was agreed that all station transformers should be built for 13,200 volt service, using only the two standard taps, one of each primary coil.

*Rates for Incandescent Lighting.*

The discussion was started by the members of the committee, Mr. Sifton and Mr. Archibald (Mr. Philip being absent) reporting on the results of their comparisons of the old rates and methods with the proposed methods. Mr. Sifton presented a very interesting and ingenious chart showing a consumer's monthly and annual bill for any assumed consumption or number of rooms in the house.

There was a very great difference of opinion shown, and Mr. Ross finally suggested that each delegate collect all the data available covering typical cases in his own service, and from there determine what variations in Toronto's proposed system of charging would be necessary or desirable for his own requirements as to service, income, and his aims for popularizing and increasing the local consumption of electric light and power.

*Municipal Inspection of all Wiring.*

Mr. Reynolds stated that there was no law authorizing municipalities after inspecting wiring in residences, etc., to refuse a private corporation to connect thereto if the wiring is not up to standard. A municipal plant can refuse to connect to such an installation, but a municipality cannot control the wiring in residences that are connected to a private plant, in order to make them safe, not only to fire but also life. Mr. Sifton spoke on the same subject, and it was finally decided to ask the Hydro-Electric Power Commission to use their influence to have the proper legislation proposed.

Under this same heading it was decided that any legislation on this subject should be permissive, not compulsory.

The licensing of electricians was also suggested, but after considerable discussion and many suggestions it was decided to postpone this till the next meeting.

Mr. Sifton also spoke of the law passed by Quebec authorizing Montreal to lay conduits in her streets, and when laid, the wires of all companies using the streets must be put in the conduits, paying an annual rental to the city equal to fixed charges, operating expenses, etc.

Mayor Mullen then invited the delegates to a dinner at the Del Monte Hotel, to be held at the close of the evening meeting. His invitation was accepted in a very enthusiastic manner.

The meeting then adjourned to meet again at 8 p.m.

When the meeting was again called to order at 8 p.m. the following resolution was presented:—

Resolved, that the Hydro-Electric Power Commission be asked to use their best endeavor to obtain such amendments to the Municipal Acts as will enable the

Municipalities of the Province to secure by by-law the inspection of all electric wiring within the municipality, and the enforcement of such rules as will ensure safe and proper construction, and in connection therewith this Committee of Engineers will assist in any way which may be deemed advisable. Carried.

After this resolution had been discussed and carried, many other questions of personal interest were brought to the attention of the meeting and solved. Mr. Sifton asked solution of the questions regarding underground construction, paper vs. rubber insulation, etc., while Mr. Lappan secured information regarding pole line construction of special interest to Preston.

#### *Service Boxes.*

These were considered unnecessary.

#### *Specifications for Transformers.*

A committee consisting of Mr. Aitken of Toronto, Mr. Richards of Guelph, and one engineer from the Commission was appointed to draw up a standard transformer specification so as to ensure a standard regulation among transformers purchased by the various municipalities.

#### *Meters.*

A very interesting discussion resulted, and it was decided that it was desirable to maintain a standard type, that there was not much advantage in any of the standard types, and that a test dial was desirable.

#### *Feeder Regulators.*

Some of the engineers who were considering feeder regulators compared specifications and estimating prices.

The meeting was then offered the use of a private car by Superintendent Kirkwood of the G., P. & N. Ry. Co., in order to visit Waterloo, Berlin, Hespeler and Galt. The kind offer was accepted and the meeting adjourned to meet at the G., P. and N. station next morning at 9 o'clock.

After adjournment the engineers were most happily entertained by the municipality of Preston at a banquet served in the drawing room of the Hotel Del Monte.

The next morning the engineers looked over local conditions in Waterloo, Berlin and Galt. They also saw the Commission's stations in Preston and Berlin, both of which are under construction. Dinner was had in Galt, after which the members looked over Galt, and dispersed to meet again in Toronto, November 16th.

#### *Meetings of Municipal Auditors.*

A meeting of Municipal Auditors has been planned for November 15th in Toronto, to draw up a standard system of accounting to be used by all municipalities taking power from the Commission. A clear and intelligible system of accounting would be of service in overcoming the one possible argument against municipal ownership and operation.

#### *Miscellaneous Work.*

In order to determine the cost of pumping water for municipal use the annual reports for several years of the Detroit Pumping Plant were investigated and



analyzed to determine the cost per horse power used. This has been of general use to the municipalities.

The Niagara Power Union asked us to prepare lists of standard material and apparatus to be filled in by the municipalities in order to bulk the orders. This was done, but the co-operation of the municipalities was not secured by the Power Union. This has been taken care of by the Municipal Engineers in their meetings.

A report was written answering the arguments and showing the fallacies of the "Power Talks" printed in Buffalo papers as advertisements by the Cataract Power and Conduit Company, of Buffalo. These proved by incorrect figures and arrangements that power would cost more to the user in Toronto than it does in Buffalo. A careful analysis shows that their statements are not correct, or where correct are misleading.

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## HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO.

### IV. HYDRAULIC REPORTS, 1909.

#### SYNOPSIS.

##### *Dog Lake Storage Dams.*

The old Jennison Charter, purchased by the Kaministiquia Power Company, included, in addition to the development rights at Kakabeka Falls, the right to raise the water of Dog Lake three feet above normal level, and to regulate the water for their own purposes. It was recognized that the exercise of this right would, to a very great extent, reduce the ultimate capacity of the important power site at Dog Lake, and to maintain this site at its present rating it was considered necessary to remove the control of the storage from private interests and to have absolutely independent regulation.

A proposal was therefore made to the Kaministiquia Power Company to take over their interests in the Dog Lake storage, in return for which the Government was to construct storage works to control 20 feet of water on Dog Lake instead of the three feet to which the Power Company was entitled under the Jennison Charter. In view of the fact that the waters of Dog Lake could not be used to any extent for peak load storage, this proposition was very much to the advantage of the Power Company, and the independent regulation by the Government removed all anxiety as to injury to the power site at Dog Lake.

In the early part of March of the present year the negotiations were completed along the general lines indicated in Report No. 2, hereto appended, this being a revised copy of a report made previously to the Minister of Lands and Mines. Upon the completion of the negotiations, the Commission's Hydraulic Engineer was sent to Dog Lake to make the necessary surveys of the sites of the dams. This matter is dealt with in Report No. 3, hereto appended.

After the preliminary work had been completed by the Commission, the construction work on the dams was taken over by the Department of Public Works, and the Commission's Hydraulic Engineer was retained to draw up specifications and prepare plans. The surveys indicated that four dams would be required to develop the storage to the limit of capacity, and the plans were prepared accordingly. It was decided, however, to call for tenders for the construction of the two main dams only, leaving the construction of the other two to a later date. The estimated cost of these two dams was approximately \$40,000, and the contract was let for \$35,600, the work being in progress at the present time.

In October the Commission's Hydraulic Engineer visited the site of work.

##### *Mississippi Storage.*

In January, 1909, a deputation representing the municipalities upon the Mississippi River waited on the Commission for the purpose of soliciting Government aid in the matter of improving the power conditions of the Mississippi River. The question was considered and a report was prepared, in which the construction of three storage dams was proposed. The scheme is outlined in Report No. 5, hereto appended. Details are furnished as to the material benefits to be derived by the various municipalities interested, together with an estimate of capital cost.

*Renfrew Power.*

In the fall of 1908 the municipality of Renfrew, being threatened with a shortage of power for their municipal requirements, applied to the Commission for assistance and advice in the matter of developing a small power on the Bonnechere River within the corporation limits. A report was prepared, approving of the scheme and giving an estimate of cost, and a by-law was passed authorizing the Council to borrow the amount necessary to carry out the work.

In April, 1909, while the town was negotiating for the purchase of the power site, some trouble arose over the value of a piece of property above the development site which would be affected by backwater. The Commission was asked to determine a basis of valuation for this property, and the matter is set forth in detail in Report No. 6, hereto appended.

At this time also the town had trouble with the Renfrew Milling Company. This company was part owner of a water privilege immediately below that purchased by the town, and there was some uncertainty as to whether the Milling Company could back the water up sufficiently to injure the town's property.

Pending the investigation of this matter, the town, as a protective measure, obtained an option on the portion of the privilege which was not owned by the Milling Company.

Negotiations were still in progress when in April, 1909, the dam of the Renfrew Milling Company was carried away by the spring freshet, and the Milling Company then made a proposal that the town take over their water rights and develop the full available head. In return for the concession of their rights the Milling Company was to be supplied free with power in any quantity required up to 235 horse power. The Commission was asked to consider this proposal and reported against it, advising that the privileges of the Milling Company be purchased outright for a fixed sum, and power sold at a price sufficient to at least cover the annual charges on development. This matter is set forth in detail in Report No. 7, hereto appended.

Acting on the Commission's advice, the town entered into negotiations with the Milling Company and allied interests, and a figure was quoted which was considered reasonable. The question was then once more referred to the Commission, together with the town's estimate of revenue from contracts obtainable, and their estimate of annual charges. While the scheme as a whole was reasonable, some details were open to criticism, and the question is analyzed in Report No. 8, hereto appended. Although the scheme has not yet been reduced to a working basis, there seems no reason why it should not ultimately be carried to a successful issue.

*Nipigon Power.*

In May, 1909, a Buffalo Company applied to the Commission for information in connection with the power at Cameron's Pool on the Nipigon, having in view the possible establishment of a pulp industry. Report No. 9, hereto appended, was prepared for this company's information, and the Commission's Hydraulic Engineer was sent to Buffalo to lay the situation before them. This power is the one which another private corporation proposes to develop for the supply of Port Arthur.

*Huntsville Power.*

In response to a request from the municipality of Huntsville, the Commission's Hydraulic Engineer was in September, 1909, sent to investigate power conditions in the Muskoka River watershed, and report on the possibility of obtaining power

for the municipality of Huntsville. The most important point considered was the possibility of diverting a portion of the Lake of Bays waters into Peninsula Lake, in order to take advantage of the 104 foot difference in level between these lakes for power purposes. Other possible sources of power were also examined, and the matter is fully set forth in Report No. 10, hereto attached.

### *Moirra Storage.*

A project to improve the Moira River for power purposes was the subject of considerable negotiation during the year 1907, between the Commission and the Committee representing the Moira municipalities. In November of 1907 the Commission's Hydraulic Engineer was sent to investigate conditions in the Moira watershed, and a report was prepared in December of the same year and forwarded to the Committee. In this report it was stated that the figures submitted therein were approximate only, and that a detailed instrumental survey of the storage basins would be necessary before any definite conclusions could be arrived at.

In August and September of 1908 the Commission received copies of resolutions passed by the municipalities in the Moira watershed, asking that this survey be made, and in January of 1909 a party was placed in the field to carry out the work. The survey was completed by the end of March, 1909, and a revised report was prepared, which is now in the hands of the municipalities. See Report No. 11, hereto appended.

Up to the present time the Commission has not been asked to take any further action in the matter.

In addition to the cases above specified, numerous enquiries of a hydraulic nature have been answered verbally or by letter, and it is in connection with the answering of enquiries of this kind that the need of more general and complete hydraulic information with regard to the power and storage possibilities of the Province is required.

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## REPORT No. 1.

### DOG LAKE STORAGE.

- (a) *Report on Storage Possibilities.*
- (b) *Report on Surveys.*
- (c) *Specification for Construction of Dams.*
- (a) *Report on Storage Possibilities.*

Information received from meteorological records with regard to rainfall, and from a civil engineer of Port Arthur with regard to the Dog Lake watershed, indicates that the total estimated run-off of the watershed will be about 40,591 millions of cubic feet under mean conditions of precipitation.

Assuming the normal summer level of Dog Lake at elevation 1,370, a ten foot rise of water level would make the maximum storage elevation 1,380. According to this civil engineer's plan, the minimum elevation of the sluiceway sills would be about 1,360, so that there would be a total draft on the sluices of 20 feet. By drawing down the lake 15 feet from elevation 1,380 it would be possible to maintain a continuous discharge of 1,000 cubic feet per second from Dog Lake for 255 days



out of the year. To maintain this discharge for the remaining 110 days would require 9,504 million cubic feet of unstored run-off, and as the estimated unstored run-off is about 18,427 million cubic feet, it might reasonably be supposed that this amount of now regulated flow would keep the minimum above 1,000 second feet for the above-mentioned interval. This, however, could only be determined by experiment.

The above calculations were based upon a mean annual rainfall of 25 inches, of which 50 per cent. (12.5 inches) was assumed available for storage. There will, of course, be seasons when the precipitation will fall below this, but it will be noted that under the conditions outlined there will be 20 per cent. of the total storage capacity of the lake held in reserve from year to year, so that, leaving out the possibility of two extremely dry years occurring in succession, this reserve capacity should be able to make good the deficit of any one dry year.

If we consider the extreme minimum, as evidenced by the records of rainfall at Port Arthur, the available precipitation for run-off would be about 7 inches. The available precipitation on the watershed would then be about 22,755 million cubic feet, which is equivalent to 15.5 feet on the sluiceway sills, and would furnish a continuous discharge of something over 700 cubic feet per second. From this it might be assumed that 700 second feet is the minimum continuous flow to be derived from Dog Lake, with 1,000 second feet as a probable figure.

With regard to an agreement with the Kaministiquia Power Company, it would seem advisable to consider the question of the basis of the discharge from the outlet of Little Dog Lake. In this way all necessity for the discussion of possible power development at Dog Lake would be obviated—that is, if the Commission agreed to maintain the discharge from Little Dog Lake at or above a certain minimum.

It is to be noted that the primary function of the projected works is to provide artificially a more constant and regular flow than is possible with the river in its natural state, and consequently the waters in Dog Lake should be manipulated solely for storage purposes, and not under any circumstances for load factor accommodation. This means that all plants operating below Little Dog Lake must provide load factor storage, at or near their respective headworks, to impound any unused portion of the approximately continuous discharge from Dog Lake, as regulated by the Government. In case of development of Dog Lake it would mean that the fluctuating discharge through the wheels in the power house must be supplemented by a discharge through the dam sluices of sufficient volume to maintain the minimum discharge agreed upon at the outlet of Little Dog Lake.

In any agreement thus drawn up there should be inserted a conditional clause to the effect that should any method be proposed by the various companies generating power on the river by which the water can be otherwise regulated to their mutual advantage, the same shall be submitted to the Commission, and the Commission will endeavor to control the storage as far as possible in accordance with their wishes. In this event the manipulation of the water for load factor accommodation might be permissible.

It may be said that the question is simply one of improving, as far as possible, the natural conditions of flow in the Kaministiquia River. The discussion should be carried on in terms of storage and volume of flow, and the words "horse power" should be eliminated.



*(b) Report on Surveys.*

Presented herewith is a report on the survey of the sites for the proposed storage dams at the outlets of Dog Lake, on the Kaministiquia River, with accompanying plans, contours, cross-sections, etc. These plans are based upon an instrumental survey, and the lines and levels were checked in such a way as to prove them reasonably accurate, so that they can be safely used for estimating purposes.

*South-west Wing-dam.*

This portion of the survey resulted in a material change in the plans of a Port Arthur Engineer, upon which the details of the scheme were originally based. The cross-section chosen by him for the S.W. wing-dam was at the mouth of the so-called "lost channel," at which point the bed-rock was covered by 16 feet of saturated peat. This fact gave rise to the supposition that for a comparatively small outlay the channel could be opened up sufficiently to allow the waters of Dog Lake to be drawn down, if necessary, to elevation 1,360, or 10 feet below normal level (El. 1,370), thus giving 20 feet of water on the sills of the regulating sluices, it being the intention to raise the water level to El. 1,380.

It was found, however, that the bed-rock about 350 feet back of this section rose to within one foot of the natural surface, and continued more or less in this position for the remaining length of the channel, about 750 feet.

A new cross-section was therefore located by means of borings and test-pits upon this ridge of bed-rock, which, while considerably longer than that located by the Port Arthur Engineer, will permit the construction of a dam having only half the maximum height and one which can be built on an absolutely dry base without unwatering, while upon the previously chosen location the unwatering would have been a serious problem, probably involving the use of steel sheet-piling.

The previous and revised locations of this wing-dam are shown on the general plan, and Profile No. 1 gives the details of the revised location.

*South-west Channel.*

As the topographical conditions at the site of the S.W. wing-dam proved unfavorable, it was thought well to make a more or less detailed examination of the S.W. outlet, with a view to ascertaining what amount of rock excavation would be necessary to give the depth of run-off which the S.W. wing-dam channel had previously been considered capable of providing. For this purpose the channel of the S.W. outlet was cross-sectioned and the lake entrance sounded. This information has been incorporated in the general plan, and sufficient data will be found thereon to make a reasonable estimate of the amount of rock excavation necessary to lower the channel to El. 1,360, and also to determine the dimensions of crib-work necessary for unwatering.

Of the rock to be removed probably 30 per cent. is loose rock and boulders, and the remainder solid rock, though it was not possible to approximate this definitely, owing to the ice and snow.

The location of the dam in the S.W. channel is shown on the general plan, and also in detail on Profile No. 2. The cross-section is practically the same as that chosen by the Engineer from Port Arthur.

*North-east Channel.*

This is the main outlet of Dog Lake, and is shown on the general plan and also in detail upon Profile No. 3. This cross-section is about 40 feet above that chosen

by the Port Arthur Engineer. The revised location will be more favorable for unwatering, and the shore slopes will permit of safer and better abutment construction, more especially in the event of construction of a timber dam. It was not possible to take soundings in this channel, which had a maximum depth of about four feet, with a boulder bottom. The depth to bed-rock on this portion of the profile is therefore uncertain, but should not average more than four feet. This cross-section is located in the middle of a rapid of considerable velocity, and the water at the crest was not more than eighteen or twenty inches deep at the time of the survey.

The construction of this dam will probably be the main item of the projected works, both as to quantity of material and expense in unwatering.

#### *North-east Wing-dam.*

This wing-dam is a long, low structure which will be necessary to cap a low ridge, as shown on the general plan and also in detail upon Profile No. 4. Borings made along this location showed rock within eight inches to one foot of the surface where there was no actual out-crop. Owing to uncertainty as to whether this was bed-rock or boulders, two men were left to sink test-pits every fifty feet along the doubtful section, and their report should shortly come to hand.

#### *Timber.*

The timber in the country adjacent to the shores of Dog Lake consists of tamarack, spruce, jack-pine and poplar. There is abundance of round timber adjacent to the sites of dams suitable for the construction of temporary cribs for unwatering purposes, but if the construction of more or less permanent timber structures is considered, square timber will be necessary, and this will be very difficult to procure. There is a fair amount of timber adjacent to the shores of Dog Lake, mostly tamarack, which will square up ten by ten inches, twelve feet long, with here and there a stick which will square up twelve by twelve inches or better. Probably most of the ten by ten inch timber would produce a twenty foot stick with a wain, which in this case would not be a serious fault.

The great bulk of the timber would have to be towed across the lake, any distance up to fifteen or twenty miles, and special precautions would have to be taken to tow the green tamarack.

#### *Construction.*

In the construction of these works it would seem that the two main objective points should be, first, to give the twenty foot run-off which was talked of during the preliminary negotiations; and second, to supply storage water from Dog Lake during the next low-water season, if at all possible.

In this event the first piece of work should be the construction of a coffer-dam at the mouth of the S.W. channel. This could be started at once, with round timber sufficient for the purpose right at the site. The rock in the S.W. channel could then be removed to El. 1,360 during the summer and fall, and in the early winter months of 1910 the water could be lowered two or three feet in the lake, say to El. 1,365, by means of sluices in the S.W. coffer-dams. This would serve the double purpose of providing storage water for power, and of unwatering the N.E. or main channel. With lake level at 1,365, the boulder channel at the head of the rapids would project probably two feet above lake level, and reduce the flow in the main channel to such an extent that it could be controlled by a wooden flume, and possibly might cut the flow off completely. This would enable the base for the

main dam to be stripped to bed-rock, and the lower and more massive sections of the dam could be placed before the spring freshet. The construction of the wing-dams could, of course, go on independently at any time.

It will be seen that the above plan obviates the necessity of teaming cement this spring. All that it would be necessary to take in this spring would be material for the building of the coffer-dam, material and apparatus for taking out the rock and camp supplies, provisions, etc. The Kam tote-road should be able to handle the bulk of this class of freight if the work is rushed. Good puddle clay for the coffer-dam was located in one of the test-pits about a quarter of a mile from the site of the coffer-dam.

In the meantime plans for the main structures could be perfected, the cement shipped by water this summer and delivered to Dexter or Kaministiquia. The hauling to the lake could then commence next fall under the most favorable circumstances, the requisite storage would be supplied, and the unwatering expenses reduced to a minimum.

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## REPORT No. 2.

### MISSISSIPPI STORAGE.

#### *Mississippi River.—Re Storage on Upper Lakes.*

##### (1) *General.*

The watershed of the Mississippi River is contained principally in the Counties of Frontenac, Lanark and Carleton, and embraces an area of about 1,400 square miles. The large lake area in this watershed has been extensively used by the lumber companies to obtain storage water for driving purposes, with the result that a large number of lumbermen's dams were built, which are at present in a more or less dilapidated condition.

The deforestation of this watershed has had the usual result of producing heavy spring floods, with small and insufficient discharge during the period of minimum flow. It is the wish of the power users along the river to have the minimum flow augmented as much as possible, by having the old lumbering dams at the outlets of several of the larger lakes torn out and replaced by tight and permanent structures, the water thus impounded to be used and regulated for power purposes only.

##### (2) *Precipitation and Run-off.*

The mean value of annual precipitation on the watershed of the Mississippi is approximately thirty inches, this being assumed as a safe value for an average year. A study of the characteristics of the watershed and the climatic conditions gives rise to the opinion that only about 33 1-3 per cent. of this precipitation is available for power purposes, the remainder being dissipated by evaporation (see page and the requirements of vegetation). Subsequent calculations, therefore, will be based upon the assumption that only ten inches of the annual rainfall is accounted for in the annual run-off of the watershed.



### (3) *Natural Storage Basins.*

In the northern portion of Frontenac County, chiefly in the Townships of Palmerston, Clarendon and Barrie, are a considerable number of lakes of good size, which constitute the headwaters of the Mississippi River. Of these lakes the principal are:

Mazinaw .....	6.8	sq. miles area.
Long .....	4.37	" " "
Mississigagon .....	2.1	" " "
Gull .....	9.18	" " "
Cross .....	5.46	" " "
Indian .....	2.2	" " "

Of the above lakes, only the areas of Cross, Gull and Long Lakes have been accurately determined, these lakes being considered the best suited for storage purposes, and the topographical features of the outlets being favorable for dam construction.

Mississippi Lake has been omitted from the above list of possible storage basins, as a dam already exists at its outlet, which supplies power for several industries in Carleton Place, to which the lake is adjacent. This lake cannot, therefore, be utilized to any extent for storage purposes.

### (4) *Storage Capacity and Annual Run-off.*

Using the above figures for available precipitation and lake area, the following figures obtain:

Gull Lake.....	57 sq. mill.	1,283 mil. cubic ft.	1,324 mill. cubic ft.
Long Lake.....	148 " "	613 " " "	3,438 " " "
Cross Lake .....	434 " "	2,760 " " "	10,083 " " "
Carleton Place.....	942 " "	4,656 " " "	21,875 " " "
Almonte .....	984 " "	4,656 " " "	22,851 " " "
Pakenham.....	1,310 " "	4,656 " " "	30,422 " " "
Galetta .....	1,402 " "	4,656 " " "	33,558 " " "

### (5) *Carleton Place.*

The storage water available to Carleton Place is 4,656 millions of cubic feet, and the annual run-off is 21,875 millions of cubic feet, leaving 17,219 millions of cubic feet to be distributed naturally over portions of the year when storage water is not required. The above-mentioned quantity of storage water, if properly regulated, would maintain a continuous uniform flow of 600 cubic feet per second for three months at Carleton Place, which is equivalent to 54 horse power continuous 24-hour power per foot of head, at the turbine shaft, 80 per cent. efficiency.

### (6) *Almonte.*

The storage water available to Almonte is 4,656 million cubic feet, and the annual run-off 22,851 million cubic feet, leaving a non-regulated surplus of 18,195 million cubic feet to be distributed naturally over nine months of the year. The stored run-off will maintain a continuous uniform flow of 600 cubic feet per second at Almonte for the remaining three months of the year. This is equivalent to 54 horse power continuous 24-hour power per foot of head at the turbine shaft.



(7) *Pakenham.*

The storage water available to Pakenham is 4,656 million cubic feet, and the annual run-off is 30,422 million cubic feet, leaving a non-regulated surplus of 25,766 million cubic feet to be distributed naturally over nine months of the year. The stored run-off will maintain a continuous uniform flow of 600 cubic feet per second at Pakenham for the remaining three months of the year. This is equivalent to 54 horse power continuous 24-hour power per foot of head at the turbine shaft.

(8) *Galetta.*

The storage water available to Galetta is 4,656 million cubic feet, and the annual run-off is 33,558 million cubic feet, leaving a non-regulated surplus of 28,902 million cubic feet to be distributed naturally over nine months of the year. The stored run-off will maintain a continuous uniform flow of 600 cubic feet per second at Galetta for the remaining three months of the year. This is equivalent to 54 horse power continuous 24-hour power per foot of head at the turbine shaft.

(9) *Summary of Power Capacities.*

In the following summary the normal low-water flow, as given in the fourth report of the Hydro-Electric Power Commission, has been used for the various locations on the river, and the extreme minimum of approximately 150 second feet, which obtained during the latter part of 1908, has been assumed as applying to all locations except High Falls. These figures would apply closely to Carleton Place and Almonte, but would probably be too low for Pakenham and Galetta, as these two latter towns have the flow of several tributary creeks which reach the main stream below Almonte. These small tributaries are, however, of little importance during the period of minimum flow, so that it will be reasonable to assume uniform conditions throughout.

Location.	Available head in feet.	Capacity at normal low water.	Capacity, extreme minimum.	Estimated capacity with storage.
High Falls.....	72	915 H.P.	655 H.P.	3,900 H.P.
Carleton Place.....	12	272 "	160 "	655 "
Almonte.....	51	1,390 "	695 "	2,780 "
Pakenham.....	18	540 "	250 "	980 "
Galetta.....	25	780 "	340 "	1,365 "

(10) *Survey and Construction Details.*

While the attached estimate gives a reasonable indication of the capital expenditure which would be necessary for the construction of the proposed work, sufficient data are not at hand for accurate determination of quantities or details of design. Before proceeding with construction, therefore, it would be necessary to make detailed surveys of the sites of the various dams with cross-sections, soundings, etc. It will also be noted that in computing minimum power capacity the period over which it would be necessary to use storage water has been taken at three

months. In the case of Pakenham and points below this assumption seems quite reasonable owing to the large surplus run-off, but in the case of Almonte, Carleton Place and above there is room for doubt, and the only means of definitely establishing the point is by means of frequent measurements of flow and water level at different points along the river during the different seasons. If storage water be required for a longer period than that specified above, the minimum flow will be correspondingly decreased and vice versa, but in any case it is safe to say that the construction of the projected works would be of material and lasting benefit to the power users on the Mississippi, and the sites of the dams are of such a nature as to insure safe and permanent structures.

#### (11) *Estimates of Capital Cost.*

The estimates presented herewith include the estimated cost of three concrete storage dams located at the outlets of Cross, Long and Gull Lakes. The most expensive structure will be that at Cross Lake, where the possibility of raising the water eighteen (18) feet above normal winter level is contemplated. This will entail the construction of about 450 lineal feet of dam, with necessary spillways and sluices. The Gull Lake estimate provides for the construction of 200 lineal feet of dam designed to raise the water five (5) feet above winter level. The Long Lake estimate provides for the construction of 180 lineal feet of dam designed to raise the water five (5) feet above winter level.

##### *Cross Lake Dam.*

Dam removal and excavation.....	\$1,200	
Concrete and regulating apparatus.....	31,800	
Coffer-dam and unwatering.....	3,300	
		<hr/> \$36,300

##### *Gull Lake Dam.*

Dam removal and excavation ....	\$ 500	
Concrete and regulating apparatus .....	1,700	
Coffer-dam and unwatering.....	2,000	
		<hr/> 4,200

##### *Long Lake Dam.*

Dam removal and excavation.....	\$ 500	
Concrete and regulating apparatus.....	2,300	
Coffer-dam and unwatering.....	2,000	
		<hr/> 4,800

Total .....	\$45,300	
Engineering and Contingencies, 10 per cent.....	4,500	
Interest during construction, 2½ per cent.....	1,200	
Land damages, say .....	2,000	
		<hr/> \$53,000

#### *Supplementary.*

In the above estimates, in order to make the new construction absolutely independent of the old dams, an item covering the cost of new coffer-dams has been included. If the old dams could be made sufficiently tight to use as coffer-dams, the total capital investment (\$53,000) would be reduced to about \$47,000.

Also, for present needs, it would seem sufficient to build a new dam at Cross Lake only, and put temporary repairs on the other two dams. As Gull and Long Lakes drain into Cross Lake, the Cross Lake dam should be able to take care of any leakage through the wooden structures at Long and Gull Lakes, all regulation being handled at the Cross Lake dam. Under these conditions the capital cost would be reduced from the above amount to about \$39,500.

February 17th, 1909.

## REPORT No. 3.

## RENFREW POWER.

Our Hydraulic Engineer visited Renfrew in April, 1909, to determine and report on the value of a certain property which the town wishes to acquire in connection with its contemplated power development.

The property in question belonged equally to Messrs. T. A. Low and J. H. Barnet.

The cause of the dispute was that the price asked by the owners of this property (Barnet and Low) was considerably in excess of what the town considered them entitled to receive, and the question turned on the point as to whether the property in question had any claim to be called a water-power, or whether it should be classed as an ordinary water lot.

All the property was originally part of the Russel estate, and in April of 1899 this property was deeded to Mr. Low, along with nineteen (19) acres of land at different points on the river between the C.P.R. bridge and the plant of the Renfrew Power Company, this parcel comprising practically all the water-power on the Bonnechere within the limits of the town of Renfrew. In October of the same year a portion of the above property was deeded to Mr. Hough. A portion of this transferred property is now held by the town under option, and the town wished to acquire some additional property from Barnet and Low. The natural head on this property is due to a flat rapid which has a drop of eighteen (18) to twenty-four (24) inches during the low-water period, but is entirely obliterated during high water by the back-water of the Hough dam immediately below. The dam shown on the plan does not at present exist, but was built by a Mr. Russel some years ago for storage purposes; but it is said that he was obliged to tear it out on account of back-water damage occasioned to property on the river above. Mr. Russel was obliged upon one occasion to pay \$300.00 damages for flooding the kilns of the Brick and Tile Company, whose property is shown on the map. The channel of the river at the site of this old dam has a very uncertain bottom and the left bank is low, the topographical features on the whole being unfavorable for dam construction. It will, therefore, be seen that from the point of view of economical development the site is practically worthless as it stands. In arriving at the conditions upon which the value of this property should be based, the question should be considered from two viewpoints, namely, its value to the town and its value to the present owners.

Value to the town: The dam on the Hough property, which the town has optioned, makes available a head of seven (7) to eight (8) feet during low water, and five (5) to six (6) feet during high water, when the back-water of the Renfrew Milling Company's dam is properly regulated. The acquisition of the Barnet and Low property would enable the town to utilize eighteen (18) to twenty-four (24) inches of extra head during low stages of the river, but would be of practically no benefit during the flood period. It will be seen, therefore, that owing to the back-water from the Hough dam the material benefit to be derived from the purchase of the Barnet and Low property will be a constantly varying quantity, the variation being from zero at high-water stages to a maximum during extreme low water. Thus the value of the Barnet and Low property lies solely in the fact that the town would be enabled to install permanent works capable of permanently holding head-water at or about flood level, and derive the benefit of the extra head during that portion of the year when it is not provided by natural conditions of flow.



Value to present owners: Considered as a site for power development, it is evident that the property in its present state has no value, and the question is now to determine under what conditions it would be entitled to consideration from a hydraulic standpoint. To begin with, the class of service required by the town does away with all consideration of average power capacity and makes necessary the consideration of minimum capacity only. From information at hand it seems certain that 15 horse power per foot of head is a very liberal estimate for the minimum power capacity of the Bonnechere River in the vicinity of Renfrew. This being the case, it seems reasonable to assume that nothing under a head of four (4) to six (6) feet (60 to 90 horse power) would entitle this location to be classed as a water-power. The back-water damages due to the creation of such a head would be quite extensive, and would involve the purchase of practically the whole plant of the Brick and Tile Company, the purchase of a considerable portion of the Ferguson property, and flooding privileges along the water-front of Aberdeen Park. It would also flood the lower end of Ready Street, and seriously interfere with the waterworks piping system as at present located. All things considered, it is very doubtful if sufficient privileges could be secured from the various parties interested, above and below the railway bridge, to raise a commercially feasible head on the Barnet and Low property, and in view of this it is submitted that the property in question should not be classed as a potential water-power, and should be appraised on the basis of its realty value only, as would be the case should the town be obliged to acquire rights farther up the river.

The town controls the road allowance across the river at Raglan Street. There is said to be a head of about six (6) feet on this property under natural conditions, and the town wishes for a report on this property as a possible source of power. At the time of our Engineer's visit to Renfrew the property was submerged by a flood and back-water from the Renfrew Power Company's dam, and no reliable data could be procured until later in the season.

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Presented herewith is an estimate of the probable cost of developing 350 horse power at the second chute of the Bonnechere River, in the Town of Renfrew.

An estimate of the cost of developing an eleven foot head for municipal purposes was made some months ago for the Town of Renfrew, and a by-law empowering the Council to spend \$35,000 in the development was passed last spring. In the meantime, however, the dam of the Renfrew Milling Company just below the property which the town proposed to develop was carried away by the spring freshet. Mr. Fred Hough, of Renfrew, has a water lot and mill privilege in connection with this dam upon which the town has option for \$10,000, and since the destruction of the dam the Milling Company has made the following proposition, viz., that the town purchase the Hough rights for the amount above mentioned, and also take over the rights of the Milling Company. As a return for the making over their rights to the town, it was stipulated that the town was to develop the property and supply them free with electric power in any quantity required up to 225 horse power.

The Milling Company has been drawing about 135 horse power from this privilege, and three other industrial concerns have been drawing about 100 horse power from the same source. This 235 horse power, in addition to the municipal and other minor requirements, would probably make up the 350 horse power provided for in the accompanying estimate. Under ordinary conditions the \$7,700 of



annual charges would be chargeable to this 350 horse power, making the annual cost about \$22 per horse power. In this case, however, there would be no revenue from the 135 horse power supplied to the Milling Company, and the annual charges would have to be met from 350 less 135, or 215 horse power; that is, 215 horse power would have to be charged for at the rate of \$36 per horse power per year to meet the annual charges of \$7,700. A bad feature of this scheme would be that at any time the Milling Company might call on the town for the balance of the 225 horse power, and another generating unit would have to be installed at a cost of about \$12,000, from which there would be absolutely no revenue until a market was found for the surplus power.

The scheme in its present shape does not look commercially feasible, and, all things considered, the best plan would be to purchase outright, for a fixed sum, all the privileges for which a clear title can be shown, and to sell the converted electric power to the various consumers as required, and for a price which will amply cover annual charges. This would appear to be the only safe plan for the town to follow, and, failing this, it would be well to take up the original scheme of developing the eleven foot head, after first determining definitely to what extent the water can be legally backed up from the Milling Company's dam, about which question there has recently arisen some uncertainty.

Before the whole question can be decided, there are many small points which will require consideration, but the settlement with the Milling Company is the main issue, and the feasibility of the scheme depends primarily upon the terms to which the Milling Company will agree, and afterwards upon the price the consumers are willing to pay.

It is recommended that the Commission take no further action in the matter, until the town has had an opportunity to deal further with the Milling Company, and reports progress.

*Estimate.*

Dam, head works and power house .....	\$14,400	2%	\$288
Hydraulic equipment and accessories .....	7,400	5%	370
Electric equipment and accessories .....	4,300	6%	258
Motor, pump and accessories .....	2,600	6%	156
Excavation and unwatering .....	9,700	...	...
Town's share of cost of storage (say) .....	3,000	2%	60
Alterations in piping system (say) .....	3,000	...	...
	\$44,400	....	\$1,132
Engineering and contingencies, 10% .....	4,440	....	....
Cost of Hough privileges .....	17,000	....	....
	\$65,840		
Interest during construction, $2\frac{1}{2}\%$ (\$65,840) .....	1,646	....	....
Annual interest, $4\frac{1}{2}\%$ (\$67,486) .....	....	....	3,037
Sinking fund (30 years) (\$67,486) .....	....	....	1,019
Operation .....	....	....	2,500
Grand Total .....	\$67,486	....	\$7,688

The above estimate covers the dam, head works and power house for a plant of 720 horse power ultimate capacity, with one penstock and unit installed for 350 horse power initial capacity. The ultimate capacity is based on the probable flow which would result from the building of storage dams, for which an allowance has been made in the estimate. A head of 37 feet would result from the pro-

posed combination of the 11-foot head now owned by the town, for which \$7,000 was paid, and the head of the Renfrew Milling and lower Hough property, the lower Hough property being held under \$10,000 option as mentioned above.

The proposition submitted by the Power Committee of the Municipality of Renfrew has been carefully considered, and the following conclusions are submitted:—

(1) That the annual charges will not be met by developing the site for 375 horse power and selling the output for \$20 per horse power per year.

(2) That the town would not be justified in paying \$40,000 for the Milling Company's rights and giving them power for \$20 per horse power.

(3) That if a market were available for 700 horse power the site could be developed for full capacity and power sold for \$20 at a profit.

Conclusion No. 1.—It will be noticed that in the Power Committee's estimate of annual charges, nothing has been allowed for operation and administration. In our estimate submitted under date of August 2nd, 1909, \$2,500 was allowed to cover this item. Doubtless the committee considered that as the power and waterworks plants will be combined under the proposed scheme, the operating charges on the waterworks would cover the whole. This, however, does not appear justifiable, and at least \$1,500 would be allowed for operating and administration charges on the power proper. This would bring the committee's total annual charges up to \$8,639 for 375 horse power, or \$23 per horse power year.

Conclusion No. 2.—For argument's sake assume that the site will be developed for full capacity of 700 horse power on a co-operative basis, assessing the consumers pro rata to meet annual charges. On this basis of the August estimate the annual charges for full development would be approximately \$9,000. As the Milling Company's interests will use 200 horse power they will be liable for two-sevenths of the annual charges of about \$2,500. They will be saved this amount by the present scheme and in addition will have the interest on \$40,000, which at 5 per cent. would amount to \$2,000, making \$4,500 in all. To offset this, they agree to pay \$4,000 a year for 200 horse power, leaving a balance of \$500 a year in favor of the Milling Company's interests. This sum capitalized at 5 per cent. would be equivalent to \$10,000. It is therefore submitted that a price of \$30,000 for the Milling Company's interests would be fair to all parties, though until full capacity was developed and sold the municipality would be the loser.

Conclusion No. 3.—Using the August estimate as a basis, the total capital cost for full development would be about \$122,000 and the annual charges \$12,700 assuming \$40,000 as the price paid to the Milling Company's interests. Under these conditions, therefore, annual charges could be met by selling 700 horse power for \$18 per horse power per year, so that an available market of 700 horse power and a price of \$20 per horse power would place the scheme on a paying basis.

In view of the above facts the town would clearly not be justified in entering into a contract to supply only 375 horse power at \$20 per horse power. When the detailed estimate of the town's engineer is prepared, an approximate rate could be established, which would be satisfactory to the Commission. This rate would be adjusted yearly, as the market expanded, and by the time the full capacity had been developed and sold, there is no doubt that power could be sold for less than \$20. This would seem to be the only way to safely handle the scheme from the Commission's standpoint.

In the scheme outlined by the committee, they figure the sinking fund on a thirty year basis, while the terms of the power contracts are for ten years only. This is a matter which may require consideration.

## REPORT NO. 4.

## NIPIGON POWER.

*Power Site at Cameron's Pool.*

This power site is the most important on the Nipigon, and from the standpoint of topographical conditions is one of the finest in the Province.

As will be seen from this plan the scheme of development is remarkably simple, and the capital cost per horse power very low indeed.

Tugs can, under ordinary conditions, travel eleven or twelve miles up the river from Nipigon Station to within about two miles of the Cameron's Pool power site.

Further navigation is impossible owing to the Camp Alexander Rapids, which extend about four miles up the river. Natural obstacles of this kind extend all the way up the river at intervals of one to six miles until Lake Nipigon is reached.

They are as follows:—

Camp Alexander Rapids. ....	2½ mile portage.
Lake Jessie Narrows .....	Very shallow water.
Split Rock .....	¼ mile portage.
Island Falls.....	Short portage, 7.5 feet rise.
Pine Portage .....	2 mile portage.
White Chute.....	¼ mile portage.
Flat Rock.....	1 mile portage into Lake Nipigon.

These portages all occur in a distance of about twenty-two miles, and the total rise in this distance is 250 feet.

As shown in the table of the plan, discharge measurements were made upon this river extending over a period of one year, and the minimum recorded discharge is 5,800 sec. feet in March, 1906. For estimating purposes in the Commission's Fifth Report the discharge was taken as 5,500 sec. feet, or 500 horse power per foot of head at the turbine shaft. The hydraulic capacity of the Cameron's Pool site is then 19,500 horse power minimum under ordinary low water conditions, though a drought like that of last summer would possibly reduce this somewhat.

In our estimate in the Fifth Report the possibility of transmitting power to Port Arthur was considered, and the following is a summary of our figures:—

Turbine capacity of plant.....	16,850 H.P.
Low tension power delivered to Port Arthur, all losses deducted.	14,025 H.P.
	Capital Cost. . . . . Annual Charges
	\$ . . . . . \$
Development.....	673,182 . . . . . 63,504
Step-up Transformation.....	140,838 . . . . . 19,485
Transmission.....	416,175 . . . . . 27,981
Step-down Transformation .....	130,213 . . . . . 16,692
Patrol .....	..... 2,250
Administration .....	..... 6,656
Totals .....	1,360,408 . . . . . 136,568
Cost of 1 H.P. to build on basis of 14,025 H.P. delivered at Port Arthur, \$97.00	
" " annually " " " " " "	9.75



## REPORT NO. 5.

## HUNTSVILLE POWER.

Presented herewith is a report on power conditions in the Muskoka River watershed, with special reference to such sites for development as would be available for the municipality of Huntsville.

*Prospective Market.* If hydro-electric power were available in Huntsville at the present time, contracts aggregating 400 horse power could be obtained at once. With power at a reasonable price, the municipal requirements for street and residential lighting and pumping would soon require 250 horse power. In addition to this, several summer hotels in the vicinity of development would probably be in the market for light and pumping.

*Source of Power.* The Muskoka River, with its two branches and various tributary streams, forms the most convenient source of power available to the municipality. A considerable number of good sites for power development are located in these waters, of which the more important are South Falls and Trethewey's Falls, on the south branch; Bracebridge Falls, Wilson's Falls and High Falls, on the north branch; and Marsh's Falls, the Ragged Chute and High Falls, on the Oxtongue River, this being the principal tributary of the south branch of the Muskoka River. In addition to the sites above mentioned, an important power possibility is that at the Portage, where development is possible by diversion of water from the Lake of Bays into Peninsula Lake.

Bracebridge Falls has been developed by the town of Bracebridge, which is also about to develop Wilson's Falls, and South Falls is partially developed by the town of Gravenhurst. Of the remaining sites, the following, in order of their importance, could be developed by the municipality of Huntsville: The Portage, High Falls (Muskoka River), Ragged Chute, High Falls (Oxtongue River) Marsh's Falls.

*Characteristics of Watershed.* The watershed of the south branch of the Muskoka River above the Lake of Bays has an area of about 500 square miles, the watershed of the north branch above High Falls is about 640 square miles and the Oxtongue watershed above the Ragged Chute and High Falls is about 160 square miles. The country embraced by the above areas is rough and well covered by large hardwood timber; this fact, together with the generally steep gradient of the main and tributary streams, provides better facilities for run-off and natural conservation of rainfall than most watersheds of the same order in the older portion of the Province. The small extent of drainage area is, therefore, to a certain extent compensated for by a uniformity of flow which is the natural outcome of favorable watershed characteristics. This was especially noticeable in the case of the Oxtongue River, where the discharge over the Ragged Chute and High Falls seemed considerably greater than would have been ordinarily expected from a watershed of 160 square miles, at the end of August.

*Storage Possibilities.* The main storage basin of the district is the Lake of Bays on the south branch of the Muskoka River. This lake has an area of about 25 square miles. From records extending over a period of twelve years, the minimum annual precipitation at Huntsville appears to be 28.11 inches. In view of the favorable watershed conditions it should be safe to assume that the run-off amounts to 45 per cent. of the annual precipitation (= 12.7 inches). In a minimum year, therefore, the Lake of Bays watershed will deliver approximately 14,775 millions of cubic feet at Baysville, the outlet of the lake. The capacity of Lake



of Bays per foot rise is approximately 697 millions of cubic feet, so that the run-off of a minimum year would be sufficient to raise the water on Lake of Bays 21 feet. A difference in level of 10 feet between high and low water would provide a continuous discharge of 220 second feet for 365 days. This discharge superimposed upon that due to the non-regulated run-off should make the total minimum discharge from the Lake of Bays something over 300 second-feet.

On the north branch of the Muskoka River are Mary Lake, Fairy Lake and Lake Vernon. These lakes afford good natural facilities for storage, but the large number of summer houses and resorts on the shores and the requirements of navigation would probably do away with the possibility of developing the storage on these lakes to a greater extent than at present. In a measure, the same argument applies to the Lake of Bays, but on account of the much greater area of this lake, a comparatively small fluctuation in the water level would provide storage run-off sufficient to appreciably augment the low-water discharge of the south branch. It is doubtful if the present high-water level of the lake can be raised appreciably, but possibility of lowering the outlet is worth considering, as there would be no interests seriously affected if the water were lowered below the present minimum between the end of October and the first of April.

The permissible variation of water-level on the Lake of Bays is a question which will require considerable investigation before any definite recommendations can be made.

Hollow Lake, Tea Lake and Smoke Lake, all tributary to the Lake of Bays, are also available for storage purposes. These lakes are of comparatively small size, but would be very useful owing to the fact that their development would not be subject to the restrictions which obtain in the case of the Lake of Bays and lakes in the watershed of the north branch.

*Power Capacity.* The Portage: the development of power is possible at this point by reason of the difference in the elevation between Peninsula Lake and Lake of Bays, which is normally 104 feet. This head, properly developed, would provide 9 horse power continuous 24-hour power at the turbine shaft for every second-foot discharge from Lake of Bays into Peninsula Lake.

The development of this site will require about 3,000 feet of dredging and open cut and 1,900 feet of tunnel, and in view of the large capital expenditure it would seem unwise to design the plant for less than 1,000 horse power capacity. The discharge necessary for this capacity will, therefore, be about 110 second feet.

The water thus drawn from the Lake of Bays would be discharged into the north branch of the Muskoka River and would increase the capacity of the two developments controlled by Bracebridge by about 800 horse power. On the other hand, the capacity of the development controlled by Gravenhurst on the south branch would be permanently reduced by 1,000 horse power under present conditions, by reason of the fact that the diversion of 110 second feet into the north branch would have to be compensated for by a corresponding reduction of the discharge from the lake at Baysville, which is the outlet of the south branch. While the requirements of the town of Gravenhurst do not approach anywhere near the ultimate capacity of the South Falls development, yet any scheme tending to permanently reduce this ultimate capacity would doubtless be considered a just cause for protest by the town of Gravenhurst, the more so as their loss would be a material gain to the municipalities on the north branch of the river. The only possible way to remedy this trouble would be to improve, if possible, the storage facilities of the Lake of Bays, and develop those of the upper lakes to an extent sufficient to add 110 second feet at least to the present minimum discharge from the Lake of Bays.

To determine whether or not this is possible, it will be necessary to make a number of discharge measurements at Baysville and at the outlets of the upper lakes. Further discussion as to the feasibility of this scheme must, therefore, be held over till the above data have been obtained.

The importance of this site to Huntsville, apart from the high head, is due to the fact that the transmission distance, about 10 miles, is much less than that from any other site available to the municipality.

High Falls: This location, situated on the north branch of the river, is, from a topographical standpoint, a very desirable source of power. The available head of 44 feet and the flow is sufficient to develop 1,000 horse power continuous 24-hour power under minimum conditions. This site has the advantage of being fairly accessible, as it is less than 5 miles from Bracebridge and is close to a well-travelled road. On the other hand, the transmission distance to Huntsville will not be less than 20 miles, which fact will have a very material effect upon capital cost and annual charges. The riparian rights at High Falls are privately owned and would have to be acquired by purchase before development would be proceeded with.

Next in order of importance is the Ragged Chute on the Oxtongue. A head of probably 100 feet could be developed at this location, and the flow at the time of inspection was sufficient to develop something like 1,000 horse power under the above head. Whether this flow can be maintained under minimum conditions, either naturally or by artificial means, is a matter for future investigation. The transmission distance to Huntsville is approximately 18 miles, and the great disadvantage of this site is its inaccessibility, which will not only affect capital costs, but will be very disadvantageous from an operating standpoint.

As regards High Falls on the Oxtongue, the ultimate capacity would be about half that of the Ragged Chute and the construction and operating difficulties above mentioned would be, if anything, increased, so that consideration of its availability as a source of power for Huntsville may be eliminated.

The data collected by the First Commission with reference to the upper branches of the Muskoka River are quite insufficient for the present requirements, and the measurements and investigation above mentioned will be required before any definite scheme can be submitted for the consideration of the municipality of Huntsville.

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## REPORT No. 6.

### MOIRA STORAGE.

Submitted herewith is a report dealing with the storage possibilities of the Moira watershed, which is intended to supersede the report of December, 1907, on the same subject.

Since the previous report was prepared, surveys of the storage basins have been completed and the actual areas obtained are very much less than the estimated areas, which were based upon local opinion. To offset this to a certain extent, the flood contours developed by the survey show that the depth of the storage run-off can be considerably augmented in the case of the Grimsthorpe Marsh and, to a smaller extent, in Loon Lake. This may necessitate additional dam construction and consequent greater capital expenditure, but this is largely compensated for



owing to the fact that cement is much cheaper and sand can be obtained comparatively close to the sites of dams. The latter fact we were not justified in considering in the previous estimate owing to lack of definite information.

There has been no opportunity as yet to proceed with detailed estimates and designs, and the site at Deer Lake will require further investigation before this can be done. In the meantime, however, the revised storage figures are submitted, and while the capital cost may be somewhat increased, the old figures still give a reasonable indication of the expenditure involved. On account of the much smaller amount of water to be handled, the operating expenses have been reduced, and the interest on investment increased to 5 per cent.

On the whole, therefore, the capital investment may be slightly greater, and the storage capacity will be less than previously estimated, but there seems no doubt that in spite of altered conditions the material benefits to be derived from proposed storage work are sufficient to warrant their construction.

(1) *General.* The Moira River, with its principal tributaries, the Scoutanatta River and Black Creek, takes its rise in the northern portion of Hastings and Lennox and Addington Counties, and flows into Lake Ontario at Belleville, falling about 850 feet in 100 miles. The northern portion of the drainage basin is well mineralized, a few mines being in operation at the present time, while several more could be economically developed if cheap power were available. Owing to large areas of surface rock, and the steep gradient of the river, the run-off is naturally rapid, and this condition has gradually become more pronounced with the clearing of the upper basin by the lumbering interests. Up to the present time, the flow of the river has been regulated by the lumberman, with the result that the river became useless for power purposes for a considerable period each year, owing to the fact that the storage water was all used in the spring for driving purposes. Lumbering operations being now at an end in this district, the object of this study is to determine whether or not the flow of the river can be artificially regulated so as to furnish continuous power in commercial quantities.

(2) *Available Precipitation.* Records of the Weather Bureau at Madoc and Bancroft extending over a period of 14 years indicate that the maximum value of mean annual temperature is about 43 degrees, and the minimum value of mean annual precipitation about 30 inches. Assuming that the most unfavorable conditions for any year would obtain from a combination of the above figures, the evaporation for a season of this kind would be in the neighborhood of 14 inches, leaving 16 inches available for storage. In the following estimates, 15 inches has been taken as a safe value for purposes of calculation.

(3) *Natural Storage Basins.* Following the river up from its mouth, the first natural storage basin encountered is Stoco Lake, near the village of Tweed. A few miles further up stream, above the confluence of the Moira proper with the Scoutanatta and Black Creek, is Madoc Lake, near the village of Madoc. Above Madoc the only natural basin of importance is Wolf Lake. On Partridge Creek, a tributary of the Scoutanatta, is Deer Lake, and Loon Lake is at the headwaters of the Scoutanatta itself. The Grimsthorpe Marsh at the headwaters of Black Creek completes the list. Owing to rather unfavorable topographical conditions and the possibility of conflict with private interests, Madoc and Stoco Lakes have not been considered, and the estimates submitted will deal with the benefit to be derived from, and the cost of, storage works at Deer Lake, Loon Lake and the Grimsthorpe Marsh.

(4) *Assumptions.* The estimates submitted are based on the following assumptions:—

(a) That it is not practicable to use Madoc and Stoco Lakes for storage purposes.

(b) That in the event of the proposed dams being constructed at least 10 feet of water can be drawn off Loon Lake, Deer Lake and the Grimsthorpe Marsh.

(c) That the surveyed areas of the storage basins be given the following values: Loon Lake, 4.6 sq. miles; Grimsthorpe Marsh, 3 sq. miles; and Deer Lake, 1.4 sq. miles.

(d) That in view of the fact that the surveyed areas are so much smaller than those used in the previous estimate, the period of non-regulated flow may be increased from seven to eight months.

(e) All figures for horse power refer to power developed at the shaft of a good type of waterwheel at 80 per cent. efficiency.

(5) *Storage Capacity and Annual Run-off.*

	Storage.	Run-off.
Loon Lake.....	1,283 mill. cu. ft.	1,570 mill. cu. ft.
Grimsthorpe.....	836 " "	1,638 " "
Deer Lake.....	391 " "	1,395 " "
Bridgewater.....	1,674 " "	7,876 " "
Tweed.....	2,510 " "	22,477 " "
Corbyville.....	2,510 " "	34,848 " "

(6) *Bridgewater.* The storage water available to Bridgewater is 1,674 million cubic feet, and the annual run-off is 7,876 cubic feet, leaving a surplus run-off of 6,202 million cubic feet to be distributed naturally over a period of eight months each year. The available storage water would give a continuous uniform flow of 160 cubic feet per second at Bridgewater for four months. This is equivalent to 14.5 continuous 24-hour horse power per foot of head.

(7) *Tweed.* The storage water available to Tweed, not including Wolf Lake, is 2,510 million cubic feet, and the annual run-off is 22,477 million cubic feet, leaving a non-regulated run-off of 19,967 million cubic feet available for eight months. The storage water would give a continuous uniform flow of 250 cubic feet per second at Tweed for four months. This is equivalent to 22.5 continuous 24-hour horse power per foot of head.

(8) *Corbyville.* The storage water available to Corbyville, not including Wolf Lake, is 2,510 million cubic feet and the annual run-off is 34,848 million cubic feet, leaving a non-regulated run-off of 32,338 million cubic feet available for eight months. The storage water would give a continuous uniform flow of 250 feet per second at Corbyville for four months. This is equivalent to 22.5 continuous 24-hour horse power per foot of head.

(9) *Capital Cost* (subject to revision). The capital cost provides for the construction of three dams; one at Loon Lake with a maximum of 18 feet of water on the sill; one at Grimsthorpe with a maximum of 20 feet of water on the sill; one at Deer Lake with a maximum of 15 feet of water on the sill. The site at Deer Lake is clear, but it will be necessary to remove existing wooden dams at Loon Lake and Grimsthorpe.

The Deer Lake estimate is for a 50 foot dam with concrete sluiceway piers, concrete spillway, and about 200 feet of earth and rip-rap filling. The Loon Lake



dam provides for 80 feet of concrete dam, including sluice, and about 220 feet of wooden wing-dam. The Grimsthorpe dam provides for 70 feet of concrete dam, including sluice, and for the temporary repair and reinforcement of the existing wing-dam.

In addition to the dam above mentioned, it would be good policy to spend a reasonable amount yearly on the maintenance of the lumbering dams in the upper waters. These dams need not be tight, but they should be kept in a condition sufficient to withstand spring floods and release impounded water gradually. This item figures in the capital cost under the head of "lumbermen's privileges," and in the annual charges comes under the head "maintenance of lumbermen's dams."

#### Loon Lake Dam—

Dam removal and excavation .....	\$600	
Concrete .....	4,000	
Crib-dam .....	3,000	
Auxiliary wing-dams and false-work.....	2,000	
		<hr/> \$9,600

#### Grimsthorpe Dam—

Dam removal and excavation .....	\$600	
Concrete .....	3,800	
Repairs to existing wing-dam.....	1,000	
Auxiliary wing-dam and false-work .....	1,700	
		<hr/> 7,100

#### Deer Lake Dam—

Clearing and excavation.....	\$400	
Earth filling.....	2,200	
Concrete .....	2,000	
False-work.....	600	
		<hr/> 5,200

Total .....	\$21,900
Engineering and contingencies, 10% .....	2,190
Interest during construction, 2½% .....	502

	<hr/> \$24,592
Lumbermen's privileges (say).....	10,000

Total capital investment .....	<hr/> \$35,000
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(10) *Administration and Annual Charges.* Concerning the administration of such a system as is outlined in this report, it would seem advisable to vest the control in a representative commission composed of power users along the river. With the co-operation and assistance of a superintendent, the Commission would control and regulate the flow of the river in such a way as to properly serve the interests of the power users in general. This would include, primarily, operating the main storage dams so as to give as near an approximation as possible to uniform flow throughout the year; also the issuing of permits for, and supervision of, new dam construction, and alterations or additions to dams now existing; also the imposing of necessary restrictions as to the use of flash-boards, and, in case of emergency, the temporary imposition of a time limit for the use of water; finally, there would be the levying of water rentals to meet capital charges, and the collection of revenue.

Under annual charges should be included the following items:—

Maintenance of main dams, 2 per cent. . . . .	\$450
“       lumberman's dams (say) .....	600
Interest on \$35,000 at 5 per cent. ....	1,750
Operation and administration.....	3,000

Total annual charges.....	<hr/> \$5,800
Thus, yearly revenue should be approximately .....	\$6,000

(11) *Power Capacity.* For purposes of an approximate estimate of the power capacity of the river, it will be divided into sections over which the minimum flow in the dry season is assumed uniform, as contained in sections 5, 6, 7 and 8 of this report. The power capacity is calculated from the total drop over these sections.

Section.	Drop. Ft.	Min. Flow. Sec. ft.	Min. 24-hr. Power
Loon Lake to Flinton .....	190	125	2,160
Flinton to Madoc Lake.....	380	160	5,530
Grimsthorpe to Madoc Lake.....	500	81	3,700
Madoc Lake to Lake Ontario.....	265	250	6,030
Total capacity in min. 24-hr. power, 17,620 H.P.			

Assuming one-third of this quantity to be commercially available, there would be 6,000 horse power capable of development, against which there will be \$6,000 in annual charges (Sec. 10). The cost per horse power per year on this basis would then be in the neighborhood of \$1.00, but as the annual charges are to large extent constant, the cost per horse power for storage will vary inversely as the power developed.

It must be noted that as the estimate does not include a dam at Wolf Lake, no account is taken of the possible low-water discharge of the upper branch of the Moira. This would tend to increase the figures given above.

(12) *Supplementary.* It is evident that the storage basins on the headwaters can only be used to sustain a uniform flow, as their location is too remote to supply the peak-load or emergency demands of power users on the lower river. From the mouth of the river up as far as Corbyville, the gradient of the river is so steep that the dams upon it have comparatively little daily storage capacity. In view of this fact, it may become necessary to supply water for peak-load energy from a storage basin sufficiently near to the various points of consumption to insure prompt regulation. A dam at Foxboro raising the 4 or 5 miles of dead water up to Plainfield about four feet would appear to answer all requirements. This dam could be constructed for a very reasonable figure if it was found to be necessary. The chief item of expense would probably be land damages, concerning which no information is at hand.

## 5.—GENERAL.

### REPORT ON TRIP OF ENGINEERS TO EUROPE.

The object of this trip was:—

1. The study of methods and practices of European countries in connection with the building and equipment of modern high tension power transmission lines, **more** especially the following subjects, being directly and intimately associated with the Commission's power distribution system and in which great progress has been made within the last few years.

- (1) Protecting apparatus and systems, high tension fuses, lightning arresters, condenser for lightning discharges and grounding systems of high tension lines.

- (2) Insulators, with view of opening negotiations with one of the firms for supplying the Commission with balance of high tension insulators.
- (3) Cables.
- (4) Methods of treating and preserving wood poles.
- (5) Hydraulic accumulator scheme.
- (6) Some of the most modern and up-to-date high tension tower transmission lines on the continent.
- (7) Thury System of D.C. high tension transmission systems at Lyon, France, and plants of Thury, at Geneva, Switzerland.

2. To study the conditions abroad pertaining to the general use of electric power, appliances and machinery, which eventually could be introduced into Canada to further the general adoption of electric power in this country.

- (1) Motors and generators.
- (2) Incandescent lamps.
- (3) Quartzlamps.
- (4) Heating apparatus.
- (5) Apparatus for the purification of drinking water by means of ozone.
- (6) Apparatus for the manufacture of fertilizer by burning nitrogen of air.
- (7) Electric furnaces for the production of metals.
- (8) Street lighting by means of incandescent lamps.
- (9) Apparatus and appliances used by the farmers.
- (10) Conduits, paper insulated tubes, etc., for installation work.

Toronto, August 20th, 1909.

HON. ADAM BECK,

*Chairman, Hydro-Electric Power Commission of Ontario.*

Dear Sir,—With reference to my recent visit abroad, I beg to submit the accompanying reports dealing with the various subjects investigated. My assistant, Mr. Mansbendel, was sent to Europe several weeks ahead of me in order to prepare the ground, gather the necessary material, and make appointments with the different concerns.

Owing to the lack of time, only a part of our original programme, as outlined to you in my letter of April 22nd, could be followed. The most important subjects, however, were fully investigated and detailed reports of same are attached to this letter.

#### LIST OF SUBJECTS INVESTIGATED.

Insulators .....	Special report.
Incandescent Lamps .....	" "
25 Cycle Arcs and Quartzlamps .....	" "
Lightning Protection .....	" "
Water Purification with Ozone .....	" "
Electric House Heating .....	See Later.
Transformer Cables and Condenser Bushing,....	" "
Hydraulic Accumulator Scheme .....	" "
Thury System of D.C. High Tension Power Trans- mission .....	" "
Option for Aluminum Cable .....	" "



*Re Insulators.* Upon my arrival in Europe, I took up the question of insulators immediately. I found that though we had sent out specifications to the various firms concerned early in April, they were unprepared to make us any proposition, as the manufacture of their samples was not far enough advanced. Each of the five firms visited was laboring to improve on the C.E. type of Suspension Insulator, always retaining the link feature as the most vital part. I did not find any insulator which was different from, or better than, those tested here at Niagara, and which could possibly enter into serious consideration, in spite of the great number of variations which they had developed. Our suggestion regarding the furnishing of insulators according to our accepted design (O.B. Co. insulator) had been taken up at once, and samples were being made, but the testing of same had to be postponed. From the results of these tests and from what I saw at these factories, it is my opinion that the porcelain manufactured abroad is in most cases fully as good, if not better, than the American porcelain, both electrically and mechanically. On the other hand, I found that the foreign prices were with few exceptions rather high. The high duty and transportation charges offset almost entirely any gain which could be derived from the cheaper labor prevailing in those countries.

The insulators proposed by the Watson, Jack & Co., of Montreal, had been improved in the meantime so as to meet our specifications, and from a technical standpoint there is at present no reason why they could not be used on our lines.

The general impression gained from visits to the different insulator factories is a very favorable one. There is nothing that the manufacturers cannot furnish in the line of porcelain, independent of size, design and quantity. The facilities for manufacturing and the location of raw material are exceptionally favorable, and the reputation of these houses abroad leaves nothing to be desired. In the case that tests with insulators should be continued here, the different firms are willing to send us sample insulators free of cost, exclusive of duty.

*Re Incandescent Lamps.* Several firms were visited but satisfactory arrangements for the importation of metal filament lamps into Canada could only be made with the Siemens Schuckert Works, in Berlin. A detailed special report dealing with the technical features of this lamp follows later.

*Re 25 Cycle Arcs and Porcelain.* The following firms were visited:—

Siemens Schuckert Works, Berlin,

Koerting & Matthiesen, Leipzig,

Beck Arc Lamp Co., Berlin,

and a good but rather expensive low frequency lamp was discovered. The usual practice abroad is to use flaming arcs which are highly developed. Data and valuable information concerning flaming arcs were obtained from these different places.

*Re Lightning Protection.* The following places were visited:—

Siemens Schuckert Laboratories, Berlin.

Stations and Sub-stations at Moosbach, near Munich.

Stations and Sub-stations at Heimbach, Urftthalsperre, near Cologne.

Owing to lack of time several other important places of interest could not be visited. The investigation of this subject has given us particular valuable information. Over 700 installations in all parts of the world are provided with this system of protection and the results obtained in many years of service, during the most severe storms, have, without exception, been the very best. Technical details and description of this system are contained in attached special report. Two estimates for the equipment of our stations with this protective system are being prepared.



*Re Water Purification by means of Ozone.* Aside from the great merits of this system as an absolutely safe and certain method for purifying drinking water in large quantities, it is a valuable adjunct to any municipal plant, inasmuch as it requires power and that this power can be shut off during the peak-load period. The system as developed by the Siemens Schuckert Works, Berlin, was fully investigated and detailed report is attached to this letter.

*Re Electric House Heating.* Electric house heating abroad is as a rule considered a very expensive luxury owing to the high rates for current. There exist but a few installations in factories and churches in Switzerland and Italy, where water power is available. Electric cooking, however, is more generally used in spite of the high current prices, on account of its simplicity, its convenience and flexibility.

Electric cooking has proved to be cheaper than gas at 75 cents a thousand feet as long as the price for 1 kilowatt hour does not exceed 4.5 cents.

In spite of the restricted use of electric house heating apparatus, the German, Swiss and Austrian electric stove factories have developed a remarkable industry, mostly to supply the demand abroad. There are in use several distinct systems of heating—stove heating, air heating, and recently an English house has developed a system of electric radiator in which oil is heated electrically.

The tendency of late is to build large tile stoves of large heat storage capacity which, when fully heated, can be disconnected from the power during the peak-load period. This feature is a very recommendable one and any system of heating embodying this principle of heat storage could be introduced to users of Commission's current to good advantage. Valuable data in the form of figures, curves and text books were obtained dealing with the general conditions of cooking in European countries.

With regard to motors, generators and transformers, the following houses were visited:—

Siemens Schuckert Works, Berlin and Nuremberg.

Bergman Co., Berlin.

Both are important firms engaged in the manufacture of large generators, motors and transformers. The Nuremberg factory takes care of the manufacture of all transformers and standard apparatus, whereas the Berlin works are engaged in building special motors and generators of large capacity. The S.S.W. transformers show an exceptionally good mechanical design, providing against all possible deformation of the vital parts due to short circuits or other troubles on the line. They build air and oil cooled transformers, the latter having specially constructed steel tanks of large cooling surface. The S.S.W. are also building explosion-proof motors and generators for mines, etc., and have an ingenious plant to test the safety of these apparatus under actual conditions.

*Re Cables.* The large cable works of the S.S.W., at Nonnendamm, Berlin, where power and telephone cables are manufactured, were visited. Their equipment for this class of work is the most up-to-date of its kind. The cables are tested with a 400,000 volt transformer provided with condenser bushings, which has been in constant use for over six years, giving excellent satisfaction. Cables for 150,000 volt as manufactured by the S.S.W. have been in successful use for over two years.

*Re Hydraulic Accumulator Scheme.* With regard to hydraulic accumulator scheme, we learned from the S.S.W. that such schemes were quite frequently used

abroad, and that they had built several larger plants in the northern part of Italy. At the time of our visit they showed us plans of a new accumulator scheme they were building, with a capacity of three times 4,000 horse power.

We also visited the Societe de L'Industrie Electrique, at Geneva, Switzerland, which exploits the Thury system of direct current, high tension power transmission. There exists at the present time but one installation of this kind in France, between Moutier and Lyon, which could not be visited on account of lack of time. The system, however, impresses me as impracticable and too complicated, each unit being a rotary machine requiring attendance and care. The saving eventually effected by the using of D.C. over A.C., since twice the voltage can be used for the same insulation, is greatly offset by the extreme complications of the high cost of the station and sub-station outlay, regulation and extra insulation. The D.C. system is at the present unable to compete with the A.C. system.

With regard to our endeavor to secure an option on 250 tons of aluminum from the S.S.W., I was informed that owing to the contemplated consolidation of the different aluminum manufacturers they were unable to obtain a quotation for our purposes.

I beg to draw your attention to the attached reports dealing more intimately with the technical points of the subjects.

Yours very truly,

*Chief Engineer.*

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Toronto, August, 1909.

#### REPORT ON INVESTIGATION OF HIGH TENSION INSULATORS.

The firms which were asked to submit prices and details of high tension insulators and low tension insulators were:—

Porzellanfabrik Hermsdorf S. A.

Porzellanfabrik Hentschel & Muller, Meuselwitz.

Rosenthal, Selb, Bavaria.

Kaolin, Industrie Gesellschaft, Merckelsgrün, Austria.

Schomberg & Sons, Bautzen, Saxony.

Specifications for our high tension insulators were sent to each of these firms early in April. Upon my arrival in Europe and visit to these houses, I found that none had any design to offer which would offer greater advantages than our own types. Hermsdorf was more advanced in the manufacture of a type of high tension insulators connecting up a string of their usual delta type pin insulator, as submitted to us early in February. Numerous attempts had been made by all houses to improve on the G.E. type of insulators, always retaining the interlocking feature, but in spite of the changes of mere technical nature, which were proposed and tried, no satisfactory arrangement had been found. So far as it is known, this (G.E.) type of insulator has not been used in European countries. The factories of these firms were all well equipped, some larger, some a little less spacious, but as a whole they were all larger than any American factory of this class. The materials used are Swedish and Norwegian feldspar and flint, some English clay, and mostly kaolin, which is found abundantly in those regions in which the factories were located.

The process of mixing the clay is the same in principle as the one used in the States, except that after the clay mass has been filtered it is stored away in vaults until it begins to smell, presumably on account of a process of fermentation of the mass. This happens after a period of several weeks. The forms are worked out of the plastic material in pretty much the same way as in America. In some cases a rough form is gotten up, which is dried, and when it has reached a nearly dry consistency, it is worked in the lathe like a piece of wood. In this manner pieces of complicated designs can be turned out much better than by moulding wet. Then, too, single pieces are often stuck or glued together by means of liquid mass, and no difficulty is experienced in piecing up the most complicated form. The piece is then dried and fired in the upper part of the kiln, at a temperature of somewhere in the neighborhood of 700 degrees C.; after this firing, the pieces, having the consistency of chalk, are dipped into the glazing solution and fired a second time in the lower part of the kiln at high temperature (1,700 degrees C.). The kilns are all coal fired and have three stages extending through two floors. The lower stage is the hard fire room (1,700 degrees C.), the stage on the floor above the glow fire (700 degrees C.), and the top is reversed for drying the forms outside of the kiln, to utilize all of the available heat. This system is common to all factories in Europe, and it is claimed that these two consecutive firings, to which the porcelain is subjected, gives it its superiority in mechanical and electrical strength. The test result obtained at the factories under consideration, both with their own designs and with our section, can be drawn together as follows:—

*Hermesdorf* seems to have overcome the faults adhering to their original samples. The mechanical pull is high (somewhere around 10,000 lbs.) and the puncture voltage of the insulator from 120 to 160 kilovolts under oil. Electrically the insulator has not been changed, the fittings would eventually be made according to our own specifications. From all other designs submitted, none show any advantage over our sample, in fact a parallel test in steam showed a marked better behavior of our insulator over all other samples of their design under test. Insulators with tin roofs show under test a considerable better behavior, but this result should be viewed with the utmost care, and no definite conclusion should be drawn before further extensive tests have been made. The samples *Hermesdorf* made in conformity to our own section do not show higher electrical test results, and mechanical tests are the same as on their standard make, as the same shape head is used. Comparing prices it will be found that they are more expensive than our American make, and consequently should fall out of consideration.

*Hentschel & Muller, Meuselwitz.* Have had no design of their own. They limited themselves by making a number of test samples according to our design, which gave very favorable results. Electrically, porcelain is fully as good as the best porcelain in Europe. Mechanical tests performed showed a pull of 10,000 lbs. and more before the porcelain broke. Cement in no case gave way. Prices are cheaper than any of the other houses, but whether they can compete with Ohio Brass prices is questionable, on account of duty and freight.

*Rosenthal, Selb.* Rosenthal insulators are made of probably the best but also of the most expensive porcelain. Has a very good reputation among electrical firms. Rosenthal had a type of insulator which he showed me, but which was unsuitable for our use as it then was made. Proposed to him several changes which he afterwards made. Tests on this insulator showed, however, no favorable results. Strong leakage under rain at low voltage (50 cycles). It is a question whether behavior would be better at 25 cycles. Mechanical pull of these insulators is high (12,500



lbs.). Our own type, even if at equal qualities electrically or mechanically, is too expensive to be considered. Advantages, if any, are bought at too high a price.

*Kaolin Industrie Ges. Merckelsgrün.* Their own design, which they got up after having seen our model, is a combination of ours and an ordinary petticoat pin insulator. Though it seems that five sections would eventually meet our requirements, the petticoat feature does not seem advantageous for various reasons. Tests on our sample showed no improvement over our model. Mechanical tests were failures, owing to fast work, unset cement, and faults in construction. Porcelain seems to me to be of poorer quality and make as body of other firms.

*Schomburg.* Had no original design of their own. Our model, made by them, even at our standard of quality would be out of consideration on account of high price. No tests were made with these insulators.

Samples for our own use for testing purposes can be obtained from all the different manufacturers, should we wish to continue our research at home. Follow a list of prices for both original types and our models made by European factories:—

#### PRICES FOR HIGH TENSION INSULATORS.

##### DESIGN.

	Ours.				Theirs.			
	F.O.B. Toronto.		F.O.B. Hamburg.		F.O.B. Toronto.		F.O.B. Hamburg.	
	Sect. \$ c.	Comp. \$ c.	Sect. \$ c.	Comp. \$ c.	Sect. \$ c.	Comp. \$ c.	Sect. \$ c.	Comp. \$ c.
Hermesdorf . . . . .	1 22	9 76	8 25	6 60	1 64	8 20	1 15	5 75
H. & Muller . . . . .	95	7 60	51	4 08	2 60	13 00	1 72	6 50
Rosenthal . . . . .	1 96	15 68	1 27	10 16	2 60	13 00	1 72	6 50
			F.O.B.	Factory.			F.O.B.	Factory.
Kaolin Industrie . . . . .	1 48	11 84			1 35	6 75		
Schomburg . . . . .	1 95	15 60						

#### LIST OF PRICES FOR LOW TENSION INSULATORS, LIME INSULATORS WITHOUT PINS.

	F.O.B. Hamburg.	F.O.B. Toronto, including duty.
Hermesdorf . . . . .	20, 29, 38 and 46c.	35c.
H. & Muller . . . . .	20, 29, 38 and 46c.	38c.
Rosenthal . . . . .	20, 29, 38 and 46c.	47c.
Kaolin . . . . .	20, 29, 38 and 46c.	
Schomburg . . . . .	20, 29, 38 and 46c.	

A very ingenious device used to indicate the breaking of a high tension insulator was also inspected. This device, a simple red-colored cap made of thin celluloid, is fastened over the head of the high tension pin insulators by means of two clips. The breaking of an insulator is naturally followed by a flashover setting fire to the celluloid cap and destroying the same immediately. The missing of the red cap is readily noticed by the patrolmen, and the insulator can at once be replaced. These caps are in use over the complete transmission system at Strassburg, Alsace, representing the most extensive system of distribution in Europe, and their use on these lines has resulted in a considerable saving over the old method of locating a broken insulator by eyesight.



Toronto, August, 1909.

## REPORT ON INVESTIGATION OF METAL FILAMENT LAMPS.

The metal filament lamps can be divided into two distinct groups. One group contains the tantalum group as manufactured by the S.S.W., the other group contains all the other lamps like tungsten, osram, colloid, etc., which are practically all tungsten lamps with different names. The main difference between the lamps of these two groups lies in the fact that the tantalum lamp has a ductile filament of pure metallic tantalum, whereas the filament of all the other lamps have a very fragile and brittle filament made of tungsten, which renders the lamp exceedingly sensitive to breakage. This breakage is partly offset by a lower watt consumption as compared with a tantalum lamp, the latter consuming 1.5 to 1.6 watts per candle power, whereas the tungsten lamp consumes but 1.1 to 1.2 watts per candle power. (An ordinary carbon lamp consumes 3.5 watts per candle power.)

In the face of the higher watt consumption the tantalum lamp has some advantages which make it the more economical lamp in the long run. As mentioned before, the lamp is much stronger mechanically, making packing and shipping an easy matter. Then the tantalum lamp will stand all sorts of current fluctuations up to 100 per cent., without danger of burning out, while the tungsten lamps are all more or less sensitive to the slightest voltage variation.

The factory of the S. S. W. in which the tantalum lamps are manufactured was visited. The most striking feature about these works was the great quantity of special automatic machinery used for making these lamps. The number of hands employed is nevertheless very great as certain operations, like the threading of the filament around the spider, can only be made by hand. The daily production of these works is 75,000 lamps outside of the carbon filament lamps. Five million metal filament lamps are kept in stock. Thirty miles of tantalum wires are drawn every day, the average lamp containing one foot of it.

## REPORT ON INVESTIGATION OF 25 CYCLE ARC LAMPS AND QUARTZ LAMPS.

Toronto, August, 1909.

The standard frequency in European countries being 50 cycles per second, no great difficulties are experienced with the illumination by means of ordinary arcs, either enclosed or open. With the growing electrification of railroads, however, where 25 cycles are used, the demand for a low frequency lamp has increased very rapidly, and the problem has so far been solved in two ways.

The first and more common way is to use a flaming arc, which as far as the light is concerned gives satisfactory results. Owing to the relatively large volume of incandescent gases, the illumination is nearly steady, and no disturbing effect due to low frequency is experienced, as long as there are no moving bodies around. A pure carbon light is practically excluded, since the flicker at 25 cycles would be very disagreeable to the eye.

A second way of illuminating with current of low frequency has been developed by the S. S. W., Berlin. This firm uses a system of double lamp in one frame, one lamp being fed by a current which is lagging 90° in phase behind the current of the other lamp. Thus the illumination, which is the sum of the illumi-

nation from the two individual lamps, is practically constant and approaches more than anything else ever tried the illumination with direct current.

The cost of the lamp is necessarily high, being a double lamp, and the installation requires additional apparatus, like choke coils and condensers, and a double line along the whole circuit. Where, however, an absolutely steady light is needed, this lamp is unquestionably the best one on the market.

We visited several large manufactories: The S. S. W. lamp factory, the Koerting & Matthiesen, who are manufacturers of the Excello lamp, which is being sold in the States, the Beck Flaming Arc Company, who also propose their flaming arc as the correct solution of the 25 cycle illuminating problem.

Both the S. S. W. and Koerting people make first-class flaming arc lamps, which can be safely recommended.

With regard to Quartzlamp, which is an improved mercury vapor lamp, using a quartz tube instead of one made of glass, we found that though the current consumption of these lamps is very low ( $\frac{1}{2}$  watt per candle power), the maintenance of the lamp is very high. The tubes have a life of 1,000 hours as a rule and cost new \$5, the renewal costing \$3. The lamp can be used on D. C. only, and has a further disadvantage of giving the objectionable greenish light containing no red rays. At the present stage of development this lamp is not fit for use on an A. C. system.

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#### REPORT ON LIGHTNING AND OVER-POTENTIAL PROTECTIVE SYSTEM OF THE SIEMANS SCHUCKERT WORKS (S. S. W.), BERLIN.

Toronto, August, 1909.

The lightning and over-potential system for high tension transmission lines developed by the S. S. W. is based upon very exhaustive scientific research, and is the result of practical experience gained on over 700 installations equipped with this system. Briefly stated, the protective system provides against any and all disturbances in the line which can possibly occur through internal or external causes. Under internal causes may be classified the opening or closing of switches, whereas any disturbance which is induced in the line by lightning discharges or the slow accumulation of static charges upon the line are due to external causes. No system, however, can prevent the lightning from striking the line. In this case a few insulators may be expected to break, but the stations themselves when properly protected will experience no trouble whatever.

The slow accumulation of static charge upon a well insulated network of transmission line is made ineffective by conducting it to earth through a grounding choke coil of very high resistance and inductance. These values are chosen so as to allow the static to flow steadily (like direct current) to earth, without undue loss of current from the transmission line. It is therefore impossible for the line voltage to rise above normal voltage, due to such static accumulation.

The more important disturbances and heavy charges induced upon the line by the discharge of lightning are taken care of by the electrolytic lightning arresters, which form part of the equipment as at present contracted for. These charges are prevented from doing damage inside of the station by placing substantial and efficient air choke coils at the terminals of each transformer. According to the views of the S. S. W.'s engineers, the so-called hour-glass spiral choke coils, as



employed by the G. E. Company, are absolutely of no value whatever. The inductance of these spirals is so slight that it would have effect upon nothing else but very high frequency surges, and the energy of those surges is infinitely small, and readily absorbed by the large capacity of the line, whereas the dangerous low frequency surges which represent a considerable amount of energy are allowed to pass freely through these coils into the transformers. These heavy charges, when properly choked at the transformer, find an outlet through the horn-gap and the electrolytic cells to earth.

The less heavy charges, which would normally not discharge through the electrolytic cells, are taken care of by the so-called fine protection, which is installed at some points along the line in conjunction with the electrolytic arresters. This fine protection consists of a horn-gap in series with a high resistance connected to ground. Thus the energy represented by the charge is absorbed through the resistance, and can under no circumstances surge back into the line, as would be the case with a dead short ground connection between horn-gap and ground.

It is a well-known fact that lightning discharges, or the opening of switches will sometimes send, dangerous surges along the line, the frequency of which is dependent of the line constants, lengths, heights from the ground, etc. The frequency of a surge can also be complex or a combination of different frequencies, for instance, the fundamental wave with superimposed harmonics. In order to take care of any such surges of different frequencies the S. S. W. employ a system of step choke coils in connection with horn-gaps and resistances, the choke coil being placed in the out or in coming feeders respectively. The step coil has usually five taps connected to as many horn-gaps, and these in turn through resistances to ground.

The combination of these different types of protective apparatus as arranged and outlined in the S. S. W.'s estimate either for ungrounded or grounded neutral constitutes a protection which has proven its merits and infallibility in over 700 installations built by this firm. Several stations and sub-stations equipped with this system of protection were visited: Moosbach, located on the outskirts of Munich, in Bavaria; and Heimbach, the famous Urftthalsperre, near Cologne, one of the largest hydro-electric plants of its kind in Europe. Personal investigation of the stations and sub-stations and interrogation of the engineers in charge gave us the evidence that the system worked to their entire satisfaction, having never given the slightest cause for complaint. The step choke coil system for instance, worked so perfectly that the attendants at the station could invariably tell the exact location of a broken insulator from the operation of a certain horn arrester. During lightning storms troubles which could have been due to these were entirely unknown in these stations.

The S. S. W. engineers demonstrated to me through a series of experiments made at their laboratories the fundamental principles upon which they had developed their protective system. The superiority of the horn arrester over the roller arresters was conclusively shown by a classical experiment. A very ingenious lightning arrester for low voltage lines was also shown under operation, as well as a step choke coil with its two sets of horn arresters.

### CONCLUSION.

Substantial and efficient choke coils at the end of the line are absolutely necessary for the protection of the transformers. The protection of the lines and apparatus through electrolytic arresters alone is not sufficient because these arresters

are sensitive to abnormally excessive disturbances only. An additional protection along the lines proposed by the S. S. W. is strongly recommended. If this system is applied to our stations and lines, it is my belief that they have received the best known protection.

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REPORT ON INVESTIGATION OF ELECTRIC WATER PURIFICATION BY  
MEANS OF OZONE.

Toronto, August, 1909.

The system of purifying drinking water electrically by means of ozone as developed by the Siemens Schuckert Works, Berlin, has been in practical use for over eight years in two stations, namely in Paderborn and Wiesbaden, Germany, giving excellent results. Curiously enough, the water used for drinking purposes in Germany especially, is naturally very pure, making the use of any purification system illusory, though the system has been developed and brought to its present high standing by German firms. Wherever the water contains bacteria, which are a danger to the health, it must be purified, and in every case where cheap water power is available the ozone plant will have decided advantages over ordinary filtration plants for the following reasons:—

A filtration plant which uses large sand filtration beds is a source of constant trouble and requires eternal vigilance. The slow working sand filter retains but the solid matter and is wholly ineffective in retaining those elements which are of danger to the health. Since all the dirt and filth is retained in the form of a layer on the top of the sand beds all the water that is subsequently passed through the filter must pass through this film, and it has been shown again and again that those films are the best breeding beds for bacteria. If, through frost or other causes a single bed is cracked, the water is allowed to pass freely through this opening, often for a long time before the trouble is discovered. Furthermore, the plant for a large city requires very much space; maintenance and operating expenses are high, and worst of all the results obtained are doubtful at their best.

The purification of the water by means of ozone is preceded by a forced filtration through a special rapid filter of small dimensions, in order to eliminate all solid matter. After this filtration the water is brought into intimate contact with the electrically generated ozone, which is air containing a surplus of very active oxygen. This oxygen burns up all organic matter (bacteria) which is contained in the water, and a surplus of ozone is spontaneously turned into air and partly kept absorbed in the water. The whole equipment of such a plant is very simple and requires comparatively little space. The current consumption for a town of the size of Toronto would roughly amount to 500 horse power for the purification of the total water supply used.

The very exacting German authorities, after a series of most severe tests with water treated by ozone have pronounced their entire satisfaction with regard to the obtained results. The water is being freed from any bacteria which could possibly endanger the health, and from any inherent bad taste, and contains no trace of any odor or taste that would be due to the treatment. The S. S. W. have contracts on hand to furnish and erect ozone plants in the cities of Paris, France, and St. Petersburg, Russia. Paris especially is known for using the very bad Seine River water, which hitherto could not be purified by any of the commonly used filtration methods.



A point of great importance in connection with an ozone plant outside of the water purification qualities is the fact that the plant consumes power, and that this power can be shut off during the peak-load period.

The S. S. W. have also developed a line of portable field outfits for military use, which have been doing good service in various countries, especially during the Russian-Japanese war.

Specific data of cost and details of system are contained in several reports which were handed to us by the engineer of the S. S. W.

During the year 1909 substantial progress has been made towards the final fulfilment of the work which your Commissioners have been entrusted with. A number of important tenders such as insulators, interswitching and transformer station equipment, etc., have been finally consummated, particulars of which will be found in the Engineer's report.

A great deal of time was taken up in numerous and lengthy negotiations between the Commission, City of Port Arthur and the Kaministiquia Power Company. Contract was finally entered into as follows:—

THIS AGREEMENT, dated the Ninth Day of September, 1909,

BETWEEN KAMINISTQUIA LIGHT, HEAT & POWER COMPANY, LIMITED, hereinafter called the Company, Party of the First Part, and HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO, hereinafter called the Commission, Party of the Second Part,

WITNESSETH: That the parties covenant, promise and agree each with the other as follows:—

1. The Company hereby agrees:—

(a) At the expiration of ninety days' notice in writing from the Commission to the Company, to deliver 1,100 horse power or more of electric power to the Commission. Said notice shall be given not later than 31st January, 1910.

(b) At the expiration of ninety days' notice, which may be given from time to time during the continuance of this agreement, to deliver from time to time to the Commission in blocks of 100 horse power each, additional electric power until the total amount so delivered shall amount to 10,000 horse power.

2. The Company hereby agrees to deliver, and the Commission agrees to purchase and pay for the said several quantities of electric power on the terms and conditions of this agreement.

3. The Commission agrees:—

(a) To use all diligence by every means in its power to procure such a demand from the municipalities, corporations, companies or persons for the power dealt with by this agreement, so that at as early a date as possible the Commission will be in a position to give the first notice above referred to to the Company for the supply of power in question, and if notwithstanding the exercise of all such reasonable diligence the Commission is not able on or before the 31st January, 1910, to give such notice, then the Company shall be at liberty to determine the agreement and it shall thereupon be no longer binding upon the parties hereto.

(b) To take power exclusively from the Company up to the said 10,000 horse power, within a radius of forty miles of the Power House of this Company.

(c) To pay to the Company for such power so delivered under the terms and conditions of this agreement at the following rates per horse power per annum:—

Seventeen dollars up to 2,000 horse power, then for all \$16 up to 4,000 horse power, then for all \$15 up to 6,000 horse power, then for all \$14 up to

10,000 horse power or more. If after the Commission has ordered 5,000 horse power, a further order is given and the Company has no power beyond 5,000 horse power available, the Commission shall release the Company from all covenants to furnish power over the said 5,000 horse power, or procure the right for the Company to develop the water power at Silver Falls, under the control of the Commission at the usual annual rental, and if the said water power is developed by the Company, it shall take over the dam, constructed by the Government at Dog Lake, if then in existence, at cost, but without interest thereon. The power shall be paid for monthly in gold coin of the present standard of weight and fineness, in twelve amounts in each year at the office of the Company at Fort William, Ontario, and bills shall be rendered by the Company on the first and paid by the Commission on or before the fifteenth of each month.

4. The Commission shall pay for nine-tenths of the power ordered by the Commission and held in reserve for it as herein provided, whether it takes the same or not.

5. When the greatest amount of power taken for fifteen consecutive minutes during any month shall exceed nine-tenths of the amount ordered by the Commission held in reserve, then the Commission shall pay for this greatest amount during that entire month.

6. The points of delivery shall not be more than two miles from the present high tension transmission lines of the Company. The Company shall not be required to supply less than 400 horse power at any such point. The power shall be measured at transformer stations of the Commission. The Commission shall transmit said power over double circuit steel towers, or over other lines similar to the present transmission lines of the Company.

7. For instantaneous fluctuations that may occur from some monetary abnormal condition, the Company shall allow the Commission to take ten per cent. more than the amount ordered. If the Commission takes more than the amount of power so ordered and held in reserve for it for fifteen consecutive minutes, the Commission shall pay thereafter for an additional block of 100 horse power, and thereafter the Company shall, without notice, supply the said block of power as if it had been ordered and held in reserve by the Commission pursuant to paragraph 1 (b).

8. This agreement shall remain in force for ten years from the date of the expiration of the said 90 days' notice. The Commission may, at its option, continue this agreement for one, two or three further consecutive terms of ten years each by giving notice in writing of its intention to continue this agreement for the second term of ten years, at least three years before the expiration of the first term of ten years, and if pursuant to such notice this agreement is continued, by giving notice of its intention to continue this agreement for the third period of ten years, at least three years before the expiration of the second term of ten years, and if pursuant to such last mentioned notice this agreement is continued by giving notice of its intention to continue this agreement for the fourth term of ten years at least three years before the expiration of the third term of ten years.

9. The electric power herein contracted for shall be three phase, alternating, commercially continuous twenty-four hour power every day of the year, except as provided in paragraph 17 hereof.

10. It is agreed that maintenance by the Company of approximately the agreed voltage at approximately the agreed frequency at the said point of delivery shall constitute the delivery of all power involved herein and the fulfilment of all operating obligations hereunder; and that when voltage and frequency are so maintained, the amount of the power, its fluctuations, load factor, power factor, distri-



bution as to phases, and all other electric characteristics and qualities are under the sole control of the Commission, its agents, customers, apparatus, appliances and circuit.

11. The several blocks of power herein provided for shall be the amounts which the Company shall from time to time hold in reserve upon the order of the Commission and the Commission shall not at any time take more than the amount so ordered and held in reserve for it.

12. The Commission shall so take power that the kilovolt amperes so taken shall not at any time exceed by more than ten per cent. the kilowatts held in reserve for it and this provision shall apply proportionately to each circuit and phase. If after ten days' notice from the Company to the Secretary of the Commission and to the Clerk of any Municipality under contract for a supply of said power from the Commission, the kilovolt amperes exceed more than 10 per cent. the kilowatts held in reserve for it, then the Commission shall pay for such excess kilovolt amperes as true power, but only while such excess continues.

13. The Company shall at all times use first-class, modern, standard, commercial, hydro-electric power apparatus and plant, and the power shall be delivered at approximately 22,000 volts and at approximately 60 cycles per second. The Company shall use first-class, modern, standard, regulating apparatus and all due skill and diligence to maintain the power at such voltage and frequency. The Commission shall provide transformers with taps to receive power at from 22,000 volts to 25,000 volts at points of delivery as may be required.

14. The Commission and its customers shall select and use transformers and all apparatus most suitable to receive the electric power produced by the apparatus of the Company, and the Commission's transmitting, transforming, translating, and all other apparatus and devices upon its circuits when receiving power from the Company shall be of modern, standard design and construction, and shall be operated and maintained with special reference to securing the highest efficiency and most perfect operation, not only of its own, but also of the apparatus of the Company when receiving power from the Company; and the Commission shall install, and equip all circuits with such approved protective devices as are in commercial use and operate its circuits in such a manner as will to the then greatest extent protect the apparatus and circuits of the Company from damage and interruption by lightning, short-circuiting, or otherwise. After the happenings of any of the events provided for in paragraphs 17 and 22 hereof, power shall be delivered first to the municipalities pro rata, first for waterworks service, secondly for lighting, thirdly for street railway service, after which power shall be delivered pro rata to the remaining customers of the Power Company. The power herein provided for shall be measured by curve-drawing meters. The meters shall be subject to test as to accuracy by either party hereto and shall be furnished by and installed by the Company in the transformer station of the Commission, and the Commission shall have the right to install instruments for checking the records made by the aforesaid instruments and the Commission will provide suitable space for the Company's instruments.

15. The engineers of the Commission or one or more of them, or any other person or persons appointed for this purpose by the Commission, shall have the right from time to time during the continuance of this agreement to inspect the apparatus, plant and property of the Company and take records at all reasonable hours.

16. The Company shall have the like right to inspect the apparatus, plant and

property of the Commission, and of the Municipalities, Companies and persons who are using power supplied by it through or to the Commission, and take records at all reasonable hours.

17. In case the Company shall at any time or times be prevented from delivering said power, or any part thereof, or in case the Commission shall at any time be prevented from taking said power, or any part thereof, by ice, sleet, and wind storms, shortage of water, strike, lockout, riot, fire, invasion, explosion, act of God or the King's enemies, or any other cause reasonably beyond their control, then the Company shall not be bound to deliver such power during such time and the Commission shall not be bound to pay for such power during such time, but as soon as the cause of such interruption is removed, the Company shall, without any delay, deliver the said power as aforesaid, and the Commission shall take the same and each of the parties hereto shall be prompt and diligent in removing and overcoming such cause or causes of interruption.

18. If and so often any interruption shall occur in the service of the Company due to any cause or causes other than those provided for by the next preceding paragraph hereof, the Company shall pay to the Commission as liquidated and ascertained damages, and not by way of penalty, as follows:—

For any interruption less than one hour double the amount payable for power which should have been delivered during the time of such interruption, and for any interruption of one hour or more, the amount payable for the power which should have been delivered during the time of such interruption, and five times the last mentioned amount in addition thereto, and all moneys payable under this paragraph, when the amount thereof is settled between the parties, may be deducted from any moneys payable by the Commission to the Company under this agreement, but such right of deduction shall not in any case delay the monthly payments for power contracted for by this agreement.

19. It is recognized by both parties hereto that the state of the art of production, transmission and application of electric energy is subject to constant advance, and that it is impossible by contract to cover all the requirements and conditions which time may develop: The Company and the Commission, with the approval of the Lieutenant-Governor in Council, while adhering to the provisions of this agreement, will at any time upon the request of the other, take up and in good faith fairly consider with the aid of the respective engineers any features or changes of the system as a whole, or any modifications of any of the provisions hereof, provided it shall appear to the party to whom such request is made that compliance therewith shall tend to make this agreement more effective and to make the venture of each party more successful and certain, provided, however, that any such action or the failure on the part of either party to require of the other exact conformity to the provisions of this agreement or any liberty or greater latitude to the other in course of the co-operation implied by the spirit of this agreement shall in no manner operate as or constitute a precedent or amend or change the obligation of the parties hereto.

20. This agreement is entered into subject to the provisions of the Power Commission Act and neither the making of this agreement, nor anything herein contained shall in any way limit or prejudice any rights and powers which the Commission may now have to expropriate the plant and apparatus of the said Company, or any other power company, but nothing in this agreement shall be taken to give or enlarge any power.

21. It is agreed that in case any dispute shall arise relating to the question of the performance and fulfilment of any of the terms, provisos or conditions



of this agreement, or as to the method or accuracy of the measurement of the power, or as to any question which may arise under this agreement, or as to the rights of any of the parties after the termination of this agreement, under paragraph 23, the same shall be determined by two independent persons, one to be chosen by each of the parties to such dispute and such persons before proceeding with the reference, shall appoint a third arbitrator to act with them, and the decision of the said three arbitrators or a majority of them, shall be conclusive on both parties, except as hereinafter provided, and in case either of the said parties shall neglect or fail to appoint an arbitrator within thirty days after the request in writing by the other party, then the arbitrator appointed by the other party may proceed alone and his award shall be conclusive on both parties except as hereinafter provided. The award shall be made within four months after the appointment of the first of such arbitrators, and in the event of the two arbitrators appointed as aforesaid being unable or unwilling to agree upon a third arbitrator within two weeks after their appointment or the appointment of the one of them who was last appointed, by the Chief Justice for the time being of the King's Bench Division of the High Court of Justice for the Province of Ontario, or in the event of the said Chief Justice being ill, absent from the Province or otherwise unable or refusing to act, then such third arbitrator shall be appointed by any judge of the High Court of Justice, or any Judge other than a local Judge. It is agreed that there may be an appeal by either party from any decision or award of such arbitrators to the High Court of Justice of Ontario, in accordance with the provisions of the Arbitration Act in that behalf.

22. In case the plant, apparatus, buildings or premises of the Company or any part thereof, shall at any time during the continuance of the agreement be damaged or destroyed so as to prevent the Company from supplying the said power of the quantity and quality hereinbefore provided for to the Commission, the Company shall use its best endeavors to procure the said supply of power for the Commission, otherwise or elsewhere.

23. If at any time that the quantity of power which is being taken under this agreement by the Commission shall amount to sixty per cent. or more of the total power which the Company is developing, and a complaint is then made in writing by the Commission to the Company that the Company has so continuously neglected or failed to perform the terms of this agreement that the apparatus of the Commission or its customers cannot by reason of such neglect or failure of the Company be operated to full efficiency and the Company shall not within a reasonable time remedy such neglect or failure, then the matter of complaint may be referred to the Lieutenant-Governor in Council, and if he determine that there is a just ground of complaint, he may direct that the Company shall within a time to be fixed by him, remedy such neglect or failure, and if such neglect or failure be not remedied as directed by him, the Lieutenant-Governor in Council may order that upon such terms as he may deem reasonable, including the rights of other parties, interested, the whole of the plant, apparatus and property of the Company shall be transferred to the Commission, whereupon payment and satisfaction of the said terms, the amount of which payment and satisfaction is to be settled by the arbitrators appointed as hereinbefore stated, the Commission may, with the approval of the Lieutenant-Governor in Council, take over the plant, apparatus and property and the same shall be transferred to the Commission.

24. In case the Municipal Corporation which shall contract with the Commission for a supply of power, or any person, firm or corporation which shall contract with any such Municipal Corporation, or with the Commission for a supply

of power furnished to the Commission by the Company, shall suffer damages by the act or neglect of the Company, and such Municipal Corporation, person, firm or corporation would, if the Company had made this contract directly with them, have had a right to recover such damages or commence any proceedings or any other remedy the Commission shall be entitled to commence any such proceedings or bring such action for or on behalf of such Municipal Corporation, person, firm or corporation, and notwithstanding any acts, decision or rule of law to the contrary, the Commission shall be entitled to all the rights and remedies of such Municipal Corporation, person, firm or corporation, including the right to recover such damages, but no action shall be brought by the Commission until such Municipal Corporation, person, firm or corporation shall have agreed with the Commission to pay any costs that may be adjudged to be paid if such proceedings or action is unsuccessful. The rights and remedies of any such Municipal Corporation, person, firm or corporation shall not be hereby prejudiced.

25. Subject to the provisions of paragraphs 17 and 22 of this agreement, notwithstanding there may be differences between the parties hereto as to the supply or sufficiency of the said power, or the payment therefor, or any other questions whatsoever which may arise under this agreement, the Company shall continue to deliver the power and the Commission to pay therefor, and both parties shall continue to carry out the contract notwithstanding such differences; and when the matters which may be so in issue shall be finally determined by the reference to arbitration in the manner provided by paragraph 21 hereof, the parties shall deal with such matters according to the terms of the award which may be made upon reference. It being the distinct agreement between the parties that there shall not be during the period of this agreement any stoppage or cessation in the supply of the said power or on the payments therefor, but that the same shall be continued as if there was no such difference.

26. Provided this agreement continues so long, the Company shall not, prior to the ninth day of December, 1926, directly or indirectly, supply power to any municipality, or to any person, firm or corporation therein, while such municipality is supplied by the Commission under any existing contract or under a contract entered into before the 31st day of January, 1911. Provided this agreement continues so long, the Commission shall not, prior to the ninth day of December, 1926, directly or indirectly, supply power to any municipality, or to any person, firm or corporation therein, while such municipality is supplied by the Company under any existing contract or under a contract entered into before the 31st day of January, 1911, and the Commission shall not supply power at a price less than the price hereinbefore stipulated to be paid to the Company for power together with the cost of transforming, transmitting and disposing of the same to the customers of the Commission added thereto, provided always that in no case shall the Commission sell or dispose of power at a price less than the actual cost of the same, together with all charges and expenses in connection with the disposal and sale of the same added thereto.

27. Notwithstanding anything hereinbefore contained this agreement shall not come into operation as against the Commission or be binding upon the Commission until, in addition to any other Orders-in-Council, pursuant to said Act an Order-in-Council has been passed and approved by the Lieutenant-Governor-in-Council expressly declaring that this agreement shall from the date of such Order-in-Council be binding upon the Commission, but this shall in no way interfere with the agreement contained in paragraph 3 (a), and the Commission undertakes to do all things lawful in its power that may be needed to bring this agreement into



operation at as early a date as possible and to procure the assent and declaration of the said Lieutenant-Governor-in-Council above referred to and the said Company agrees to co-operate with the Commission by all means in its power to carry out the object of this agreement.

28. This agreement shall extend to, be binding upon and enure to the benefit of the successors and assigns of the parties hereto.

IN WITNESS WHEREOF the Commission and the Company have respectively affixed their corporate seals and the hands of their proper officers.

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Acting upon the request of the various municipalities the Legislative Assembly passed the following, "An Act to amend an Act," being 9 Edw. VII., Chap. 19, as follows:—

An Act to amend an Act passed in the 7th Year of His Majesty's Reign, Chaptered 19, intituled "An Act to provide for the transmission of Electrical Power to Municipalities," to validate certain contracts entered into with the Hydro-Electric Power Commission of Ontario, and for other purposes.

*Assented to 29th March, 1909.*

**W**HEREAS by Acts passed in the 6th and 7th years of His Majesty's Reign, Chaptered 15 and 19 respectively, and each entitled *An Act to provide for the transmission of Electrical Power to Municipalities*, it is amongst other things provided that under certain conditions and subject to certain provisions therein set forth a contract may be entered into and executed by the Hydro-Electric Power Commission of Ontario and any Municipal Corporation for the purposes mentioned in the said recited Acts; and whereas in intended pursuance of the said recited Acts a contract in the form set out in Schedule "A" to this Act has been executed by all the Corporations mentioned therein except the Corporations of Hamilton, Brantford, and Galt; and whereas the Municipal Council of the Corporation of Galt has approved of and has authorized the execution of the said contract by said Corporation; and whereas as appears by the said contract, it was contemplated that the Corporations of Hamilton and Brantford would also execute it, but they have not yet done so; and whereas owing to unforeseen causes it may become impossible to supply power by the 19th day of December, 1909, as provided in the said contract; and whereas doubts have been raised as to the validity and binding character of the said contract and as to the authority of the Councils of the said Corporations to authorize and direct the execution of the said contracts and to bind the said Corporations thereby: and whereas the Corporations which have executed the said contract and the said Corporation of Galt, although it has not executed the said contract, are desirous that they shall have the benefits of the provisions of the said recited Acts and of the said contract made available to them without delay and that their enjoyment of such benefits should not be postponed by unnecessary and vexatious litigation; and whereas the Corporation of Stratford and the Corporation of Hespeler have applied

vary the Schedule to the said contract as hereinafter set forth; and whereas the Corporation of Ingersoll has applied to be added as parties to the said contract; and whereas it is expedient to remove such doubts and to validate the said contract as varied in the manner hereinafter provided:

Therefore His Majesty, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:—

Short title.

**1.** This Act may be cited as *The Power Commission Amendment Act, 1909*.

Contract varied

**2.** The contract mentioned in the preamble to this Act and set out in the Schedule hereto shall be and the same is hereby varied,—

(a) By striking out the words “Hamilton” and “Brantford,” and all words and figures relating thereto;

(b) By striking out paragraph 16 thereof;

(c) By adding the Corporation of the Town of Ingersoll as one of the parties of the second part, and inserting in the said Schedule the word “Ingersoll” in column 1, and in columns 2, 5, 6 and 7 respectively opposite that word the figures “500, \$24, \$69,485, \$3,270”;

(d) By substituting opposite the word “Stratford” in said Schedule, for the figures in columns 2, 5, 6 and 7, the following figures, “1,000, \$27.10, \$173,580, \$8,120”; by substituting opposite the word “Hespeler” in said column 1 of said Schedule the figures “300” for “400,” and by substituting for the words and figures “19th day of December, 1909,” in clause (b) of paragraph 1 of the said contract the words and figures “19th day of March, 1910, or on any earlier day on which the Commission shall be prepared to supply the same”; and

(e) By adding to paragraph 11 the following words, “No power shall be supplied by any municipal corporation to any railway or distributing company, or any other corporation or person without the written consent of the Commission.”

Contract as varied to be binding on certain municipal corporations.

**3.** Notwithstanding any provision of any by-law of the council of any of the corporations hereinafter in this section mentioned to the contrary, the said contract as so varied shall be and the same is hereby declared to be valid and binding according to the terms thereof upon the Corporation of the City of Toronto, the Corporation of the City of London, the Corporation of the City of Guelph, the Corporation of the City of Stratford, the Corporation of the City of St. Thomas, the Corporation of the City of Woodstock, the Corporation of the Town of Berlin, the Corporation of the Town of Galt, the Corporation of the Village of Hespeler, the Corporation of the Town of St. Mary’s, the Corporation of



the Town of Preston, the Corporation of the Town of Waterloo, the Corporation of the Village of New Hamburg, and the Corporation of the Town of Ingersoll.

4. It is hereby further declared and enacted that the validity of the said contract as so varied as aforesaid shall not be open to question and shall not be called in question on any ground whatever in any Court, but shall be held and adjudged to be valid and binding on all the corporations mentioned in section 3, and each and every of them according to the terms thereof as so varied as aforesaid and shall be given effect to accordingly.

Contract as varied confirmed.

5. The said contract as so varied as aforesaid shall be treated and conclusively deemed to have been executed by the Corporation of the Town of Galt.

Contract to be deemed to have been executed by town of Galt.

6. The said contract as so varied as aforesaid shall be conclusively deemed to be a contract executed by the Corporations mentioned in section 3, within the meaning of the said recited Acts, and the Commission therein named may carry out and execute the same and shall have power and authority to do all acts necessary for that purpose, and it shall not be necessary that the said contract as so varied as aforesaid be approved of by the Lieutenant-Governor in Council.

Contract to be deemed to be a contract executed in corporations named.

7. The Corporations mentioned in section 3, and each and every of them shall be conclusively deemed to have entered into a contract with the Commission within the meaning of the said recited Acts, and to have and to be entitled to exercise all the powers mentioned in the said Acts, which are thereby conferred upon a Corporation which has entered into such a contract.

Corporations to be deemed to have contracted with Commission.

8. Every action which has been heretofore brought and is now pending wherein the validity of the said contract or any by-law passed or purporting to have been passed authorizing the execution thereof by any of the Corporations hereinbefore mentioned is attacked or called in question, or calling in question the jurisdiction, power or authority of the Commission or of any Municipal Corporation or of the Councils thereof or of any or either of them to exercise any power or to do any of the acts which the said recited Acts authorize to be exercised or done by the Commission or by a Municipal Corporation or by the Council thereof, by whomsoever such action is brought shall be and the same is hereby forever stayed.

Pending actions stayed.

9. The contract between the Hydro-Electric Power Commission of Ontario and the F. H. McGuigan Construction Company is hereby declared to be legal and valid, and the Commission may carry out and execute said contract, and, in addition to all other powers of the said Commission, the Commission shall have power and authority to do all acts necessary for the purposes of said contract.

Contracts for construction of works confirmed.

Commission  
may acquire  
easements.

**10.** In addition to all other powers, the Commission may, by purchase, lease or otherwise or without the consent of the owners thereof or persons interested therein, acquire, enter upon and take possession of and use a right or easement to construct, erect, maintain and operate transmission lines with all other plant appliances and equipment required therefor to transmit electricity at such voltage as the Commission may determine, through, over, under, along or across any lands and premises, public highways or public places, streams, waters, water-courses, bridge, viaduct or railway.

Municipality  
may make  
contracts when  
authorized by  
vote of electors.

**11.** Where a municipal corporation not a party to the contract set forth in Schedule A, as varied by this Act applies for a supply of power and a question has been heretofore or is hereafter submitted to the vote of the electors of the municipality pursuant to paragraph 1a of section 533 of *The Consolidated Municipal Act, 1903*, and the amendments thereto, including the amendment made during the present session as to a supply of electric power from the Commission and the electors have voted in favor of a supply from the Commission, the Council of the corporation of such municipality may authorize the entering into and such corporation may enter into a contract with the Commission in the form set forth in the said schedule or with such variations thereof as may be approved by the Lieutenant-Governor in Council, without submitting a by-law approving the same for the assent of the electors as provided by sub-section 1 of section 13 of *The Power Commission Act*, and when executed such contract shall be legal, valid and binding.

7 Edw. VII.,  
c. 19.

Debentures  
may be issued  
within two  
years.

**12.** Notwithstanding anything contained in the by-law of the council of any of the municipalities mentioned in section 3, it shall be sufficient if the debentures thereby authorized are issued within two years from the passing of the by-law.

7 Edw. VII.,  
c. 19, s. 25, subs.  
1, amended.

**13.** Subsection 1 of section 25 of *The Power Commission Act* is amended by striking out of the fourth and fifth lines thereof, the words "Section 8 of Chapter 3 of The Revised Statutes of Ontario, 1897," and substituting therefor the words "Section 7 of *The Interpretation Act*."

8 Edw. VII.,  
c. 22, short title.

**14.** The Act passed in the 8th year of His Majesty's reign, Chaptered 22, intituled *An Act to validate certain By-laws passed and contracts made pursuant to An Act to provide for the transmission of Electrical Power to Municipalities*, may be cited as *The Power Commission Amendment Act, 1908*.

#### SCHEDULE "A."

This Indenture, made the 4th day of May, 1908, between The Hydro-Electric Power Commission of Ontario, acting herein on its own behalf and with the approval of the Lieutenant-Governor in Council, (hereinafter called the Commission), party of the First Part, and The Municipal Corporations of Toronto, Hamilton, London, Brantford, Guelph, Stratford, St. Thomas, Woodstock, Berlin, Galt, Hespeler, St. Mary's, Preston, Waterloo and New Hamburg, (hereinafter called the Corporations), party of the Second Part.



Whereas, pursuant to *An Act to Provide for Transmission of Electrical Power to Municipalities*, the Corporations applied to the Commission to transmit and supply such power from Niagara Falls, and the Commission entered into contracts, hereto attached, with the Ontario Power Company of Niagara Falls, (hereinafter called the Company), for such power at the prices set forth in the schedule hereto attached, and the Commission furnished the Corporations with estimates, as shown in said schedule, of the total cost of such power, ready for distribution within the limits of the Corporations, and the electors of the Corporations assented to by-laws authorizing the Corporations to enter into a contract with the Commission for such power, and the Commission have estimated the line loss and the cost to construct, operate, maintain, repair, renew and insure a line to transmit, nominally, 30,000 horse power with total capacity of 60,000 horse power of such power to the Corporations, and have apportioned the part of such cost to be paid by each Corporation as shown in said schedule;

Now, therefore, this Indenture witnesseth that in consideration of the premises and of the agreements of the Corporations herein set forth, subject to the provisions of said Act and of the said contracts, the Commission agrees with the Corporations respectively:—

1.—(a) To construct a line to transmit the quantities of electric power shown in column 2 of the said schedule from Niagara Falls to the Corporations shown in column 1, respectively.

(b) On the 19th day of December, 1909, to supply said power in quantities set forth in column 2 of said schedule, or as a minimum 40 per cent. less, if written notice of minimum required is given on or before 19th July, 1909, to the Corporations within the limits thereof, ready for distribution at approximately the number of volts set forth in column 4 of said schedule, and approximately 25 cycles per second frequency.

(c) At the expiration of three months' written notice, which may be given by the Corporations or any of them from time to time during the continuance of this agreement, to supply from time to time to the Corporations in blocks of not less than 1,000 horse power each, additional power until the total amount so supplied shall amount to 30,000 horse power.

(d) At the expiration of nine months' like notice which may be given by the Corporations or any of them from time to time during the continuance of this agreement, to supply from time to time to the Corporations in blocks of not less than 1,000 horse power each, additional power until the total amount so supplied shall amount to 100,000 horse power.

(e) To use at all times first-class, modern, standard, commercial apparatus and plant, and to exercise all due skill and diligence so as to secure the most perfect operation of the plant and apparatus of the Corporations.

In consideration of the premises and of the agreements herein set forth each of the Corporations for itself, and not one for the other, agrees with the Commission:—

2.—(a) Subject to the provisions of paragraph 2 (g), hereof, to pay the Commission for the quantities of power shown in column 2 of said schedule, or 40 per cent. less as a minimum, to be supplied at said date, and for such additional power supplied or held in reserve upon such notices, the price set forth in column 3 of said schedule in twelve monthly payments, in gold coin of the present standard of weight and fineness, and bills shall be rendered by the Commission on or before the fourth and paid by the Corporations on or before the fifteenth of each month. If any bill remains unpaid for fifteen days, the Commission may, in addition to all other remedies and without notice, discontinue the supply of such power to the Corporation in default until said bill is paid. No such discontinuance shall relieve the Corporation in default from the performance of the covenants, provisos, and conditions herein contained. All payments in arrears shall bear interest at the legal rate.

(b) To take electric power exclusively from the Commission during the continuance of this agreement; provided, if the Commission is unable to supply said power as quickly as required, the Corporations may obtain the supply otherwise until the Commission has provided such supply, thereupon the Corporations shall immediately take from the Commission; and the Corporations may generate, store or accumulate electric power for emergencies, or to keep down the peak load of the power taken from the Commission; and nothing herein contained shall affect existing contracts between the Corporations and other parties for a supply of electric power, but the Corporations shall determine said contracts at the earliest date possible.

(c) To pay, annually, interest at four per cent. per annum upon its proportionate part of the moneys expended by the Commission on capital

account for the construction of the said line, transformer stations and other necessary works shown, respectively, in column 6 of said schedule, subject to adjustment under paragraph 10.

(d) To pay an annual sum for its proportionate part of the cost of the construction of said line, stations and works, shown, respectively, in column 6 of said schedule, subject to adjustment under paragraph 10, so as to form in thirty years a sinking fund for the retirement of the securities to be issued by the Province of Ontario.

(e) To bear its proportionate part of the line loss and pay its proportionate part of the cost to operate, maintain, repair, renew and insure the said line, stations and works, shown, respectively, in column 7 of the said schedule, subject to adjustment under paragraph 10.

(f) To keep, observe and perform the covenants, provisos and conditions set forth in said contracts, intended by the Commission and the Company to be kept and observed and performed by the Corporations.

(g) To pay for three-fourths of the power supplied and held in reserve at said date and upon said notices, whether the said power is taken or not, and when the greatest amount of power taken for twenty consecutive minutes in any month shall exceed three-fourths of the amount during such twenty consecutive minutes, so supplied and held in reserve, to pay for this greater amount during that entire month. When the power factor of the greatest amount of power taken for said twenty minutes falls below 90 per cent., the Corporations shall pay for 90 per cent. of said power divided by the power factor.

(h) To take no more power than the amount to be supplied and held in reserve at said date and upon said notices.

(i) To use at all times first-class, modern, standard, commercial apparatus and plant to be approved by the Commission.

(j) To exercise all due skill and diligence so as to secure the most perfect operation of the plant and apparatus of the Commission and the Company.

3. If, as therein provided, the said contracts are continued until 19th December, 1939, this agreement shall remain in force until that date.

4. Said power shall be three phase, alternating, commercially continuous twenty-four hour power every day of the year except as provided in paragraph 6 hereof, and shall be measured by curve-drawing meters, subject to test as to accuracy by either party hereto.

5. The engineers of the Commission, or one or more of them, or any other person or persons appointed for this purpose by the Commission, shall have the right from time to time during the continuance of this agreement to inspect the apparatus, plant and property of the Corporations and take records at all reasonable times on giving to the Corporations six hours' notice of the intention to make such inspection. The Corporations shall have a like right on giving a like notice to inspect the apparatus, plant and property of the Commission.

6. In case the Commission or the Company shall at any time or times be prevented from supplying said power, or any part thereof, or in case the Corporations shall at any time be prevented from taking said power, or any part thereof, by strike, lock-out, riot, fire, invasion, explosion, act of God, or the King's enemies, or any other cause reasonably beyond their control, then the Commission shall not be bound to deliver such power during such time and the Corporations shall not be bound to pay the price of said power at Niagara Falls during such time, but the Corporations shall continue to make all other payments, but as soon as the cause of such interruption is removed the Commission shall without any delay supply said power as aforesaid and the Corporations shall take the same and each of the parties hereto shall be prompt and diligent in removing and overcoming such cause or causes of interruption.

7. If, and so often as, any interruption shall occur in the service of the Company due to any cause or causes, other than those provided for by the next preceding paragraph hereof, the Commission shall recover and pay to the Corporations as liquidated and ascertained damages, and not by way of penalty, as follows: For any interruption less than one hour double the amount payable for power which should have been supplied during the time of such interruption; and for any interruption of one hour or more, the amount payable for the power which should have been supplied during the time of such interruption and twelve times the last mentioned amount in addition thereto, and all moneys payable under this paragraph when the amount thereof is settled between the Commission and the Company may be deducted from any moneys payable by the Corporations to the Commission,



but such right of deduction shall not in any case delay the said monthly payments.

8. The maintenance by the Commission of approximately the agreed voltage at approximately the agreed frequency at the substation in the limits of the Corporation shall constitute the supply of all power involved herein and the fulfilment of all operating obligations hereunder; and when voltage and frequency are so maintained, the amount of the power, its fluctuations, load factor, power factor, distribution as to phases, and all other electric characteristics and qualities are under the sole control of the Corporations, their agents, customers, apparatus, appliances and circuits.

9. In case any municipal corporation, or any person, firm or corporation which shall contract with the Commission or with any municipal corporation for a supply of power furnished to the Commission by the Company shall suffer damages by the act or neglect of the Company, and such municipal corporation, person, firm or corporation would, if the Company had made the said contracts directly with them, have had a right to recover such damages or commence any proceedings or any other remedy, the Commission shall be entitled to commence any such proceeding or bring such action for or on behalf of such municipal corporation, person, firm, or corporation, and notwithstanding any acts, decision or rule of law to the contrary, the Commission shall be entitled to all the rights and remedies of such municipal corporation, person, firm or corporation, including the right to recover such damages, but no action shall be brought by the Commission until such municipal corporation, person, firm or corporation shall have agreed with the Commission to pay any costs that may be adjudged to be paid if such proceeding or action is unsuccessful. The rights and remedies of any such municipal corporation, person, firm or corporation shall not be hereby prejudiced.

10. The Commission shall at least annually adjust and apportion the amounts payable by municipal corporations for such power and such interest, sinking fund, line loss, and cost of operating, maintaining, repairing, renewing and insuring the line and works.

11. If at any time, any other municipal corporation, or pursuant to said Act, any railway or distributing company or any other corporation or person, applies to the Commission for a supply of power, the Commission shall notify the applicant and the Corporations, parties hereto, in writing, of a time and place and hear all representations that may be made as to the terms and conditions for such supply.

Without discrimination in favor of the applicants as to the prices to be paid, for equal quantities of power, the Commission may supply power upon such terms and conditions as may, having regard to the risk and expense incurred, and paid, and to be paid by the Corporations, parties hereto, appear equitable to the Commission, and are approved by the Lieutenant-Governor in Council.

No such application shall be granted if the said line is not adequate for such supply, or if the supply of the Corporations, parties hereto, will be thereby injuriously affected, and no power shall be supplied within the limits of a municipal corporation taking power from the Commission at the time of such application, without the written consent of such Corporation.

In determining the quantity of power supplied to a municipal corporation, the quantity supplied by the Commission within the limits of the Corporation to any applicant, other than a municipal corporation, shall be computed as part of the quantity supplied to such Corporation, but such Corporation shall not be liable to pay for the power so supplied, or otherwise in respect thereof.

12. It is hereby declared that the Commission is to be a trustee of all property held by the Commission under this agreement for the Corporations and other municipal corporations supplied by the Commission, but the Commission shall be entitled to a lien upon said property for all moneys expended by the Commission under this agreement and not repaid. At the expiration of this agreement the Commission shall determine and adjust the rights of the Corporations and other municipal corporations, supplied by the Commission, having regard to the amounts paid by them, respectively, under the terms of this agreement, and such other considerations as may appear equitable to the Commission and are approved by the Lieutenant-Governor in Council.

13. Each of the Corporations agrees with the other:—

(a) To take electric power exclusively from the Commission during the continuance of this agreement, subject to the provisos above set forth in paragraph 2 (b).

(b) To co-operate, by all means in its power, at all times, with the

Commission, to increase the quantity of power required from the Commission, and in all other respects to carry out the objects of this agreement and of the said Act.

14. If differences arise between the Corporations the Commission may upon application fix a time and place to hear all representations that may be made by the parties, and the Commission shall, in a summary manner, when possible, adjust such differences, and such adjustment shall be final. The Commission shall have all the powers that may be conferred upon a Commissioner appointed under *The Act respecting Enquiries concerning Public Matters*.

15. This agreement shall extend to, be binding upon and enure to the benefit of the successors and assigns of the parties hereto.

16. Notwithstanding anything hereinbefore contained this agreement shall not come into operation as against the Commission or be binding upon the Commission until, in addition to any other orders-in-council, pursuant to said Act, an order-in-council has been passed and approved by the Lieutenant-Governor in Council expressly declaring that this agreement shall from the date of such order-in-council be binding upon the Commission.

In witness whereof the Commission and the Corporations have respectively affixed their corporate seals and the hands of their proper officers.

THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO.

A. BECK.  
JOHN S. HENDRIE.  
W. K. McNAUGHT.

THE CORPORATION OF THE CITY OF TORONTO.

(L.S.) JOSEPH OLIVER, Mayor.  
R. T. COADY, Treasurer.

THE CORPORATION OF THE CITY OF LONDON.

(L.S.) S. STEVELY, Mayor.  
S. BAKER, Clerk.

THE CORPORATION OF THE CITY OF GUELPH.

(L.S.) JOHN NEWSTEAD, Mayor.  
T. J. MOORE, City Clerk.

THE CORPORATION OF THE CITY OF STRATFORD.

(L.S.) W. S. DINGMAN, Mayor.  
R. R. LANG, City Clerk.

THE CORPORATION OF THE CITY OF ST. THOMAS.

(L.S.) GEO. GEDDES, Mayor.  
S. O. PERRY, City Treasurer.

THE CORPORATION OF THE CITY OF WOODSTOCK.

(L.S.) R. G. SAWTELL, Mayor.  
JOHN MORRISON, City Clerk.

THE CORPORATION OF THE TOWN OF BERLIN.

(L.S.) ALLEN HUBER, Mayor.  
A. H. MILLAR, Clerk.

THE CORPORATION OF THE TOWN OF HESPELER.

(L.S.)

G. D. FORBES,  
Mayor.

WINFIELD BREWSTER,  
Clerk.

THE CORPORATION OF THE TOWN OF ST. MARY'S.

(L.S.) JOHN WILLARD,  
Mayor.  
L. HARSTONE,  
Clerk.

THE CORPORATION OF THE TOWN OF PRESTON.

(L.S.)

FREDERICK CLARE,  
Mayor.

H. C. EDGAR,  
Clerk and Treasurer.

THE CORPORATION OF THE TOWN OF WATERLOO.

(L.S.)

I. B. FISCHER,  
Mayor.

A. B. MCBRIDE,  
Clerk.

THE CORPORATION OF THE VILLAGE OF NEW HAMBURG.

(L.S.) J. F. KATZENMEIER,  
Reeve.  
WILLIAM MILLER,  
Clerk.

THE CORPORATION OF THE TOWN OF INGERSOLL.

(L.S.)

GEORGE SUTHERLAND,  
Mayor.

W. R. SMITH,  
Clerk.

## SCHEDULE B.

Column 1	2	3	4	5	6	7
Name of Municipal Corporation.	Quantity of power applied for in H.P.	Maximum price of power at Niagara Falls.	No. of volts.	Estimate maximum cost of power ready for distribution in municipality.	Estimate proportionate part of cost to construct transmission line, transformer stations and works for nominally 30,000 H. P., with total capacity of 60,000 H.P.	Estimate proportionate part of line loss and of part cost to operate, maintain, repair, renew and insure transmission line, transformer stations and works for nominally 30,000 H.P., with total capacity of 60,000 H.P.
Toronto .....	10,000	\$9.40 for power at 12,000 volts until 25,000 H.P. or more are taken, then for all. \$10.40 for power at 60,000 volts until 25,000 H.P. or more are taken, then \$10.00 for all. If power taken at higher voltage, price to be fixed by arbitration.	Number required by each Corporation.	\$18 10	\$828,080	\$38,970
Hamilton .....	1,500			17 50	115,650	5,442
London .....	5,000			23 50	671,080	31,578
Brantford .....	1,500			21 50	172,770	8,134
Guelph .....	2,500			24 00	347,420	16,350
Stratford .....	1,500			24 50	215,600	10,146
St. Thomas.....	1,500			26 50	244,140	11,490
Woodstock .....	1,200			23 00	155,350	7,310
Berlin .....	1,000			24 00	138,970	6,540
Galt.....	1,200			22 00	143,920	6,773
Hespeler .....	400			26 00	63,200	2,974
St. Mary's .....	500			29 50	95,677	4,502
Preston .....	600			23 50	80,530	3,789
Waterloo.....	685			24 50	98,460	4,630
New Hamburg.....	250			29 50	47,830	2,251

In the month of March the Commission asked Mr. Ralph D. Mershon, of New York, a consulting engineer of international reputation, to make an investigation as to the physical features of the Hydro-Electric scheme. Mr. Mershon came to Toronto and spent several days on the work. He reported that the work, as submitted, gives every evidence of careful thought, and would successfully transmit the power for which it is designed.

During this year the City of Hamilton, after receiving an emphatic mandate from the electors, took up the question of a supply of power with the Commission. After many meetings they finally concluded the contract to take 1,000 horse power from the Commission.

All of which is respectfully submitted.













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Annual report.

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